GROUND WAVE EMERGENCY NETWORK
FINAL OPERATIONAL CAPABILITY

ENVIRONMENTAL ASSESSMENT
FOR
CENTRAL WYOMING RELAY NODE

SITE NO. RN 8C928WY

19 February 1993

Electronic Systems Center
Air Force Material Command, USAF
Hanscom AFB, Massachusetts 01731-1623

REPORT DOCUMENTATION PAGE

Form Approved
OMB NO. 0704-0188

1. AGENCY USE ONLY (Leave blank)	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
	19 FEB 93	ENV. ASSESSMENT

4. TITLE AND SUBTITLE
GROUND WAVE EMERGENCY NETWORK
CENTRAL WYOMING RELAY NODE

5. FUNDING NUMBERS

6. AUTHOR(S)
AIR FORCE MATERIAL COMMAND

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
ELECTRONIC SYSTEMS CENTER
HANSCOM AFB, MA.
01731-1623

8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)
UNITED STATES AIR FORCE

10. SPONSORING / MONITORING AGENCY REPORT NUMBER
SITE #
RN 8C928WY

11. SUPPLEMENTARY NOTES
N/A

12a. DISTRIBUTION / AVAILABILITY STATEMENT
APPROVED FOR PUBLIC RELEASE;
DISTRIBUTION IS UNLIMITED

12b. DISTRIBUTION CODE
A

13. ABSTRACT *(Maximum 200 words)*

THE GROUND WAVE EMERGENCY NETWORK (GWEN) IS A RADIO COMMUNICATION SYSTEM DESIGNED TO RELAY EMERGENCY MESSAGES BETWEEN STRATEGIC MILITARY AREAS IN THE CONTINENTAL UNITED STATES.

14. SUBJECT TERMS
GWEN

15. NUMBER OF PAGES
200

16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
UNCLAS	UNCLAS	UNCLAS	UL

FINDING OF NO SIGNIFICANT IMPACT

NAME OF ACTION: GROUND WAVE EMERGENCY NETWORK
CENTRAL WYOMING RELAY NODE

DESCRIPTION OF PROPOSED ACTION ALTERNATIVES:

The U.S. Air Force plans to construct a radio communications relay node in central Wyoming (Hot Springs County) as part of the Ground Wave Emergency Network (GWEN) communications system. Six action alternatives associated with six candidate GWEN sites (CGSs) in central Wyoming and the no action alternative have been considered and evaluated in an environmental assessment (EA).

GWEN is a radio communications system designed to relay emergency messages between strategic military areas in the continental United States. The system is immune to the effects of high-altitude electromagnetic pulse (HEMP) energy surges caused by nuclear detonations in the ionosphere that would disrupt conventional communications equipment. A failure of such equipment would prevent timely communications among top military and civilian leaders and strategic Air Force locations and prevent U.S. assessment and retaliation during an attack. GWEN is an essential part of a defense modernization program to upgrade and improve our nation's communications system, thereby strengthening deterrence.

The GWEN system is a network of relay nodes, receive-only stations, and input/output stations. The relay node in central Wyoming would be part of the Final Operational Capability (FOC) phase of the GWEN system and would establish essential links with adjacent nodes in the network.

In September 1987, the U.S. Air Force Electronic Systems Division, Hanscom Air Force Base, Massachusetts published a Final Environmental Impact Statement (FEIS) for the GWEN FOC that addressed the system as a whole and identified expected environmental effects common to all sites. Section 5 of the FEIS described a siting process that is designed to minimize the potential for environmental impacts. This process has three distinct phases: network definition, regional screening, and individual site evaluation. Network definition identified the need for a relay node in central Wyoming. Regional screening resulted in the identification of six CGSs in central Wyoming that met the exclusionary and evaluative criteria described in that FEIS. Individual site evaluation examined the relative suitability of the CGSs through site-specific technical studies. The EA is a part of the third phase and is tiered from that FEIS. It addresses the potential environmental effects of the six action alternatives and the no action alternative.

The proposed relay node in central Wyoming will be an unmanned facility located on approximately 11 acres of land and, once constructed, will resemble an AM radio broadcast station. The facility will consist of a 299-foot-tall, low-frequency (LF) transmitter tower, three equipment shelters, an access road, and associated fences. The tower will be supported by 24 guy wires, including 12 top-loading elements. An equipment shelter at the tower base will contain an antenna tuning unit. An 8-foot-high chain link fence topped with barbed wire will surround the tower base and associated equipment shelter. A radial ground plane, composed of 100, 0.128-inch-diameter copper wires buried about 12 inches underground, will extend out about 330 feet from the tower base. A 4-foot-high fence will be installed around the perimeter of the copper radials.

A second equipment area located at the site perimeter will contain two shelters housing a back-up power group (BUPG) with two internal fuel storage tanks and radio processing equipment. The BUPG will operate during power outages and for testing purposes. An LF receive antenna, consisting of a pair of 4-foot-diameter rings mounted on a 10-foot pole, and an ultrahigh-frequency (UHF) antenna, used for communicating with airborne input/output terminals and consisting of a 9-foot-high whip-like antenna mounted on a 30-foot-high pole, will also be located in this area. An 8-foot-high chain link fence topped with barbed wire will enclose the entire equipment area. A 10-foot-wide gravel road will connect this area to the tower base. A 12-foot-wide gravel road will provide access to the site from a public road.

The station will use existing commercial three-phase electric power and telephone service. Power and telephone service will be brought to the site through either overhead or buried lines, depending on local utility practices. In its ready status, the antenna will transmit in the LF radio band at 150 to 175 kilohertz for a total of 6 to 8 seconds per hour.

Three of the six action alternatives are discussed in this Finding of No Significant Impact (FONSI). Because of significant impacts on surface water or wetlands, the Shumway (CGS-14), Galovich (CGS-15), and Brown (CGS-20) sites will not be considered in this FONSI.

ANTICIPATED ENVIRONMENTAL EFFECTS

The environmental assessment evaluated potential impacts to the physical, biological, and socio-cultural environment from construction and operation of the relay node.

The project would have no significant impacts on physical resources. Erosion and increased runoff would be minimized by using proper erosion control techniques during construction and by replanting the site afterwards. Impacts to mineral resources would be minor. Paleontological resources are not likely to occur on any of the sites; therefore significant impacts to them are not anticipated. No prime farmland would be removed from production. Water quality would not be significantly affected because increases in copper concentrations due to corrosion of the ground plane would be negligible. Air quality would not be significantly affected. During construction, temporary and insignificant increases in emissions would occur, and during operation, emissions from the BUPG would not be sufficient to result in violation of air quality standards.

The project would have no significant impacts on biological resources. The sites are used for pasture and do not contain sensitive wildlife habitat. None of the sites is within 300 feet of wetlands, and none is within a 100-year floodplain. Informal consultation with the U.S. Fish and Wildlife Service indicated that the project is not likely to adversely affect any threatened or endangered species. The Wyoming Game and Fish Commission indicated that no state-listed rare, threatened, or endangered species or unique biological communities would be affected on any of the sites. Bird-tower collisions may occur but would not be significant because the tower would be located away from primary bird habitats and migration routes.

The project would have no significant impacts on socio-cultural resources. Construction would have a small, beneficial impact on the local economy, in part by providing temporary employment for contractors and construction workers. Community support systems would not be significantly affected. Land use and noise impacts would not be significant. The relay node signal would not interfere with commercial television or radio broadcasts, amateur radio operations, garage door openers, or pacemakers. Radio-frequency emissions outside the fenced area around the tower base would not pose a health hazard to humans or animals. The Wyoming State Archives, Museums, and Historical Department was consulted and has concurred that the project would not affect significant cultural resources. Significant impacts to Native American traditional, religious or sacred sites are not anticipated. A visual analysis conducted in accordance with the criteria developed in the FOC FEIS concluded that the relay node facility would not cause significant visual impacts.

CONCLUSIONS:

No significant impacts to the surrounding environment would be caused by construction and operation of the proposed relay node on the Bunch (CGS-9), Russell (CGS-10), or Herrin (CGS-21) site. Therefore, an environmental impact statement for a GWEN relay node at the cited locations in central Wyoming is not required.

for David C. Williams, Colonel, USAF
Chairman
HQ ESC Environmental Protection Committee

25 Mar 93
Date

PREFERRED GWEN SITE REPORT
CENTRAL WYOMING

The U.S. Air Force is proposing to construct a relay node for the Ground Wave Emergency Network (GWEN) in Central Wyoming. The Air Force has followed the siting process described in Section 5 of the Final Environmental Impact Statement (FEIS) for the Final Operational Capability (FOC) phase of the GWEN program to identify alternative Candidate GWEN sites (CGSs). The six CGSs identified in Central Wyoming are referred to as the Bunch, Russell, Shumway, Galovich, Brown, and Herrin sites.

This report summarizes the process of selecting the preferred site from among the six CGSs. This Preferred GWEN Site Report (PGSR), along with a site-specific Environmental Assessment (EA) and Finding of No Significant Impact (FONSI), is being distributed for information and comment in compliance with the Air Force's process of Interagency and Intergovernmental Coordination for Environmental Planning (IICEP).

Operational, environmental, and developmental suitability; construction and real estate acquisition costs; and public comments and concerns are all factors which have been considered in arriving at the selection of the preferred site.

Without an **operationally suitable** location, connectivity of the relay node in Central Wyoming to the GWEN network cannot be achieved. Ground conductivity measurements are acceptable at all six sites. During site-specific studies, no radio frequency interference was detected in GWEN frequency bands which would interfere with the operation of the GWEN receiver. Also, operations at any of the sites would pose no interference with other known systems. UHF line-of-site coverage for a potential airborne interface would be largely uninhibited at either of the six sites. Therefore, all six sites are operationally suitable.

The next major factor considered in selecting the preferred site is **environmental suitability**. The environmental suitability of each CGS was determined from information provided by an independent field analysis and is documented in the EA. The EA was completed in February 1993. Based on the environmental analysis of each CGS, the Air Force has concluded that no significant environmental impacts would occur at the Bunch, Russell, or Herrin sites. The FONSI for these three sites was completed on 25 March 1993. Significant impacts on surface water or wetlands could occur due to copper leachate if the site were constructed on the Shumway, Galovich, or Brown site. Therefore, only the Bunch, Russell and Herrin sites are environmentally suitable.

All six CGSs are **suitable for development** as a GWEN relay node. The FAA has approved construction of the GWEN relay node at either of the six CGSs. **Construction costs** varies dramatically between the six sites due to the distance to 3-phase power and telephone, and the length of access road required at each individual site. Although construction costs are lowest at the Brown, Galovich and Herrin sites, all sites are developmentally acceptable.

The final consideration as to the preferred GWEN site is the **real estate acquisition**. The Air Force has obtained purchase / lease options on the Bunch, Russell, and Herrin sites. The lowest acquisition cost is obtained by purchasing the Herrin site.

With operational factors acceptable, environmental factors weighed, and developmental factors and acquisition costs considered, the Air Force prefers the Herrin site. The Herrin site is preferred because it ranks best overall among the previously mentioned criteria including lowest overall construction and acquisition costs for otherwise qualified sites.

Therefore, I have selected the Herrin site as the Air Force's preferred site for development as the GWEN relay node in Central Wyoming. After reviewing the information received during the IICEP process, I will prepare for construction of the relay node.

STEPHEN T. MARTIN, Lt Col, USAF
Program Manager, GWEN

14 APR 93
(Date)

GROUND WAVE EMERGENCY NETWORK
FINAL OPERATIONAL CAPABILITY

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SUMMARY

The Ground Wave Emergency Network (GWEN) is a radio communication system designed to relay emergency messages between strategic military areas in the continental United States. The system is immune to the effects of high-altitude electromagnetic pulse (HEMP) energy surges caused by nuclear bursts in the ionosphere that would disrupt conventional communications equipment such as telephones and shortwave radios. A failure of such equipment would prevent timely communications among top military and civilian leaders and strategic Air Force locations and prevent U.S. assessment and retaliation during an attack. GWEN is an essential part of a defense modernization program to upgrade and improve our nation's communications system, thereby strengthening deterrence.

The GWEN system consists of a network of relay nodes, receive-only stations, and input/output stations. Each relay node, such as the one proposed in central Wyoming, consists of a guyed radio tower facility similar to those used by commercial AM broadcast transmitters.

A Final Environmental Impact Statement (FEIS) for the GWEN Final Operational Capability (FOC) was published in September 1987 by the Electronic Systems Division, Hanscom Air Force Base, Massachusetts. That FEIS addressed the GWEN system as a whole, identifying expected environmental effects common to all sites. Section 5, beginning on page 5-1 of the FEIS, describes a siting process that is designed to minimize the potential for environmental impacts. This process has three distinct phases: network definition, regional screening, and individual site evaluation.

Phase 1, network definition, identified the geographic coordinates that met the operational needs and technical constraints of the network. Each set of coordinates became the center of a circular site search area (SSA) with a 9-mile radius (250 square miles). The SSA discussed in this Environmental Assessment (EA) was centered 0.2 mile southeast of the town of Thermopolis, in Hot Springs County, central Wyoming, at latitude 43.64° N and longitude 108.20° W. The principal town in the SSA is Thermopolis.

Phase 2, regional screening, involved the application of exclusionary and evaluative criteria to the SSA to avoid environmentally sensitive areas. The remaining areas, called potential areawide sites (PAWS), became the focus of the siting process. A field investigation for central Wyoming was conducted in April 1990. Twenty-one sites were identified during automobile-based surveys as potential candidate GWEN sites (PCGSs). Three of the sites and part of a fourth were located outside of the SSA because of a scarcity of three-phase power and all-weather roads within the SSA. The sites identified outside of the SSA were evaluated under the same FEIS siting criteria as the sites within the SSA. Attempts were made to contact the owners of the sites to determine their interest in selling or leasing land to the Government. Rights-of-entry were granted to investigate eight PCGSs. An additional four sites, under the jurisdiction of the Bureau of Land Management, did not require signed rights-of-entry. Following evaluation against the environmental siting criteria set forth in the FEIS, six of the twelve PCGSs were recommended as candidate GWEN sites (CGSs) for further review. These CGSs were described in the Preliminary Site Evaluation Report (PSER) of May 14, 1990.

Phase 3, individual site evaluation, involves evaluating the relative suitability of the candidate sites through site-specific technical studies. This EA is a product of those evaluations and discusses the six siting alternatives in central Wyoming. It addresses only those criteria that apply to the candidate sites. The seventh alternative, no action, would impair performance of the GWEN system but leave the environment unchanged.

To be suitable for construction and operation, a site should measure at least 700 by 700 feet (approximately 11 acres), be relatively level and undeveloped, be free of natural or man-made obstructions, and have soils capable of supporting relay node structures. The site should also be close to all-weather roads, commercial three-phase power, and telephone lines to minimize costs. To operate effectively, the site must be located at least a minimum distance from obstructions that could affect reception and transmission. These include buildings and towers, high-voltage power lines, and other communications systems or sources of radio-frequency interference. Specific minimum distances depend on height and power levels of identified obstructions or interfering sources.

This EA shows that construction and operation of a GWEN relay node on the Shumway (CGS-14), Galovich (CGS-15), or Brown (CGS-20) site could have significant impacts on surface water or wetlands that support aquatic plants or animals.

The project would have no significant impacts if built on the Bunch (CGS-9), Russell (CGS-10), or Herrin (CGS-21) site. During the 6-week construction period, the project would cause temporary and insignificant air quality and noise impacts and slight increases in traffic. It would have a small, beneficial impact on the local economy, in part because it would provide temporary employment for contractors and construction workers. If built on any of these three sites, the project would have no significant impacts on air quality; water quality; land use; mineral resources; known paleontological resources; biological resources, including threatened and endangered species; or cultural resources that are listed, eligible, or potentially eligible for listing on the National Register of Historic Places. Visual impacts would not be significant. Radio-frequency emissions outside the fenced area around the tower base would not pose a health hazard to humans or animals.

1.0 PURPOSE AND NEED FOR ACTION

The proposed action covered by this Environmental Assessment (EA) includes construction and operation of a relay node of the Ground Wave Emergency Network (GWEN) in central Wyoming (see Figure 1.1 of this EA). This relay node will provide essential connections with adjacent nodes in the network. The major features of a GWEN relay node and associated environmental impacts common to all sites are addressed in the Final Environmental Impact Statement (FEIS) for the Final Operational Capability (FOC) phase of GWEN, which was published in September 1987 by the Electronic Systems Division, Hanscom Air Force Base, Massachusetts. This EA is tiered from that FEIS and addresses site-specific conditions at the candidate GWEN sites (CGSs) for this particular site search area (SSA).

The purpose of GWEN is to provide to the President and the National Command Authority a strategic communications network that is immune to the effects of high-altitude electromagnetic pulse (HEMP) and will carry critical attack warning and force execution data. As a result, GWEN will remove any possibility of potential aggressors taking advantage of the electromagnetic pulse generated by a high-altitude nuclear burst. A HEMP surge would disrupt the nation's electric power line transmission capability, cripple electronic devices, and adversely affect skywave communications networks based on conventional electronics. GWEN provides a low-frequency (LF) ground wave communication network that will not be affected by HEMP effects. It thereby strengthens deterrence by removing the option of beginning an attack against the United States by using HEMP effects.

A partial GWEN network, called the Thin Line Connectivity Capability (TLCC), has been completed. It contains 8 input/output stations, 30 receive-only stations, and 54 relay nodes. The TLCC provides a limited level of HEMP-protected communications to strategic forces and the National Command Authority.

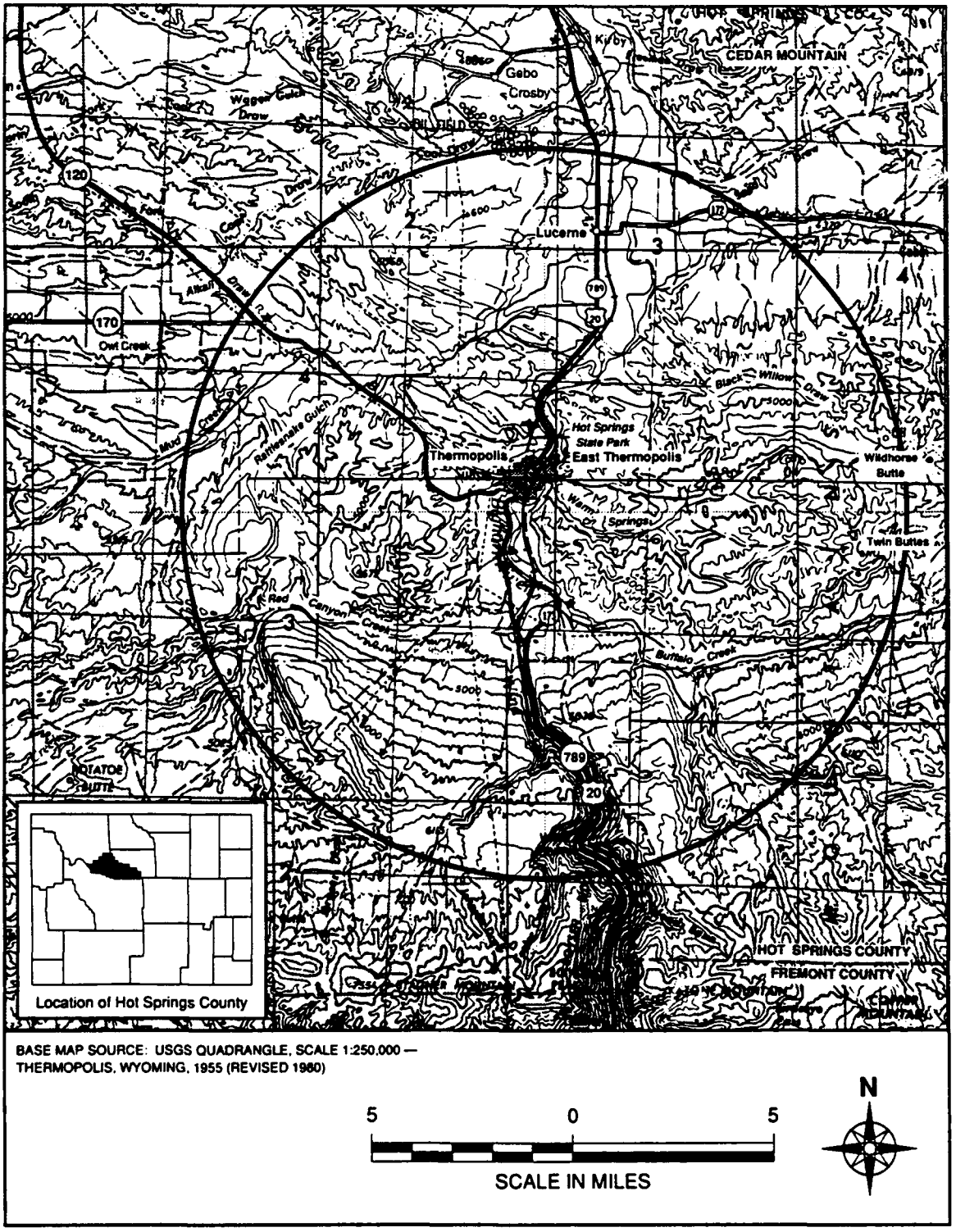

FIGURE 1.1 CENTRAL WYOMING SITE SEARCH AREA (SSA), HOT SPRINGS COUNTY, WYOMING

The FOC phase of GWEN will add 29 relay nodes. The FOC will allow communication along several routes, thereby enhancing system availability and ensuring that vital communications will be maintained.

2.0 ALTERNATIVES INCLUDING THE PROPOSED ACTION

The six action alternatives are site-specific applications of the standard relay node design presented in the FEIS. Consequently, they share a number of features that are discussed in Section 2.1 of this EA. The site-specific features are discussed in Sections 2.2 through 2.7 of this EA. Site descriptive data was obtained during field investigations conducted in April 1990. Figure 2.1 of this EA shows the six CGSs in relation to the major features of the SSA. Figure 2.2 and Appendix B of this EA show the locations of the CGSs in relation to roads and surrounding topography, respectively.

2.1 Common Features of the Action Alternatives

2.1.1 Site Selection Process

The process used to select sites is described in Section 5, beginning on page 5-1 of the FEIS. This process has three distinct phases: network definition, regional screening, and individual site evaluation. Appendix A of this EA provides a diagram of the site selection process. The environmental criteria used in this process are defined in Tables 5-1 and 5-2, pages 5-7 through 5-14 of the FEIS.

Phase 1, network definition, involved locating network nodes to optimize their performance while serving a predetermined number of users. A typical GWEN ground wave has an effective range of about 150 to 200 miles. Thus, relay nodes could not be located independently; changing the location of one would affect the connectivity with other nodes in the network. Once the optimal coordinates of the relay nodes were identified, a 9-mile-radius SSA was defined around each point to provide suitable opportunity for siting a relay node near that point. The 9-mile radius was chosen because it provided a reasonably sized search area consistent with the technical constraints on the relay node. If a significant portion of an SSA fell within an environmentally highly sensitive area such as a national park or wilderness area, an alternative was selected and its connectivity evaluated. This process was repeated until all relay nodes fell outside such areas.

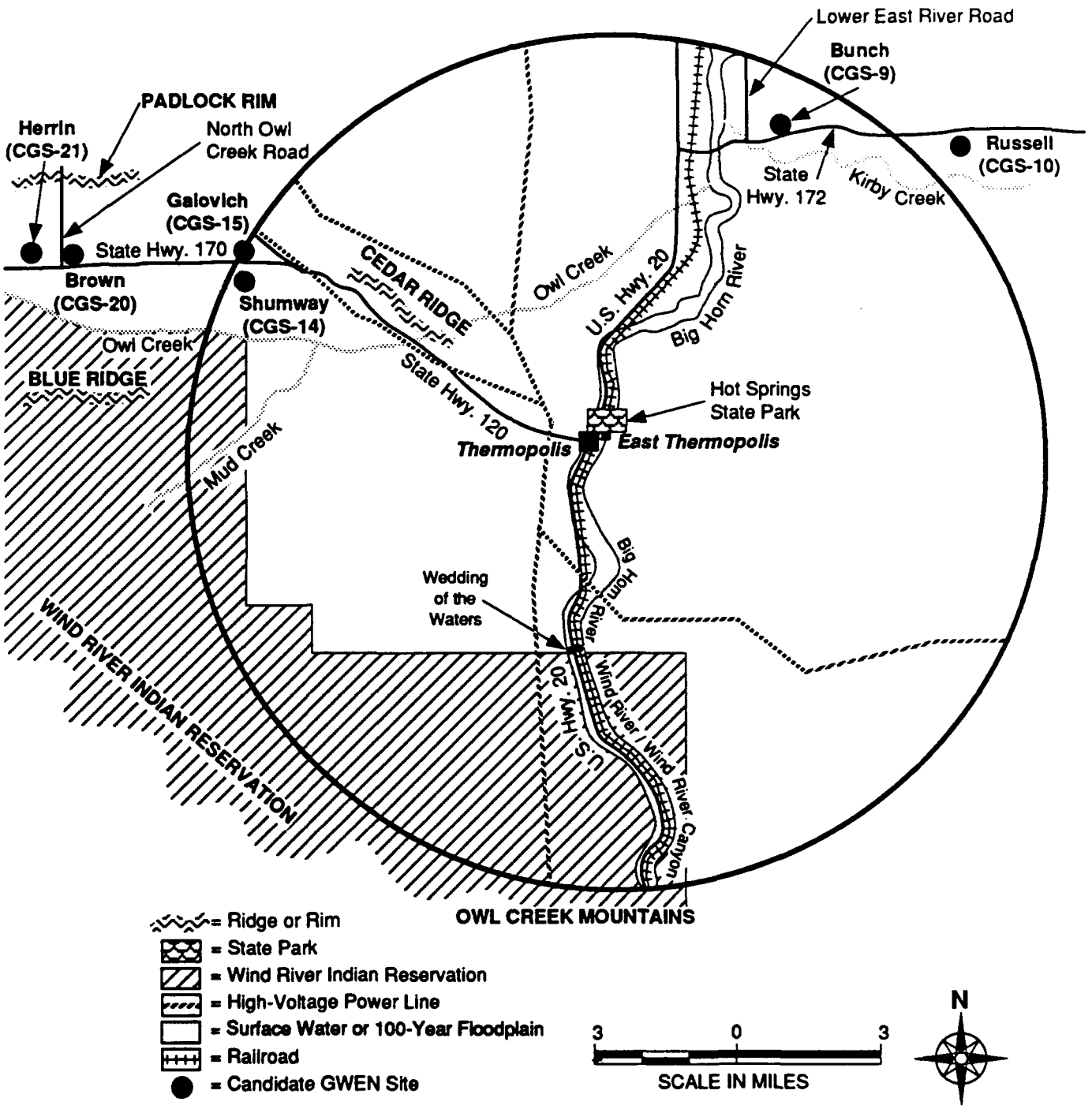

FIGURE 2.1 LOCATIONS OF CANDIDATE GWEN SITES (CGSs) RELATIVE TO SELECTED MAJOR FEATURES AND ROADS WITHIN AND NEAR THE CENTRAL WYOMING SITE SEARCH AREA

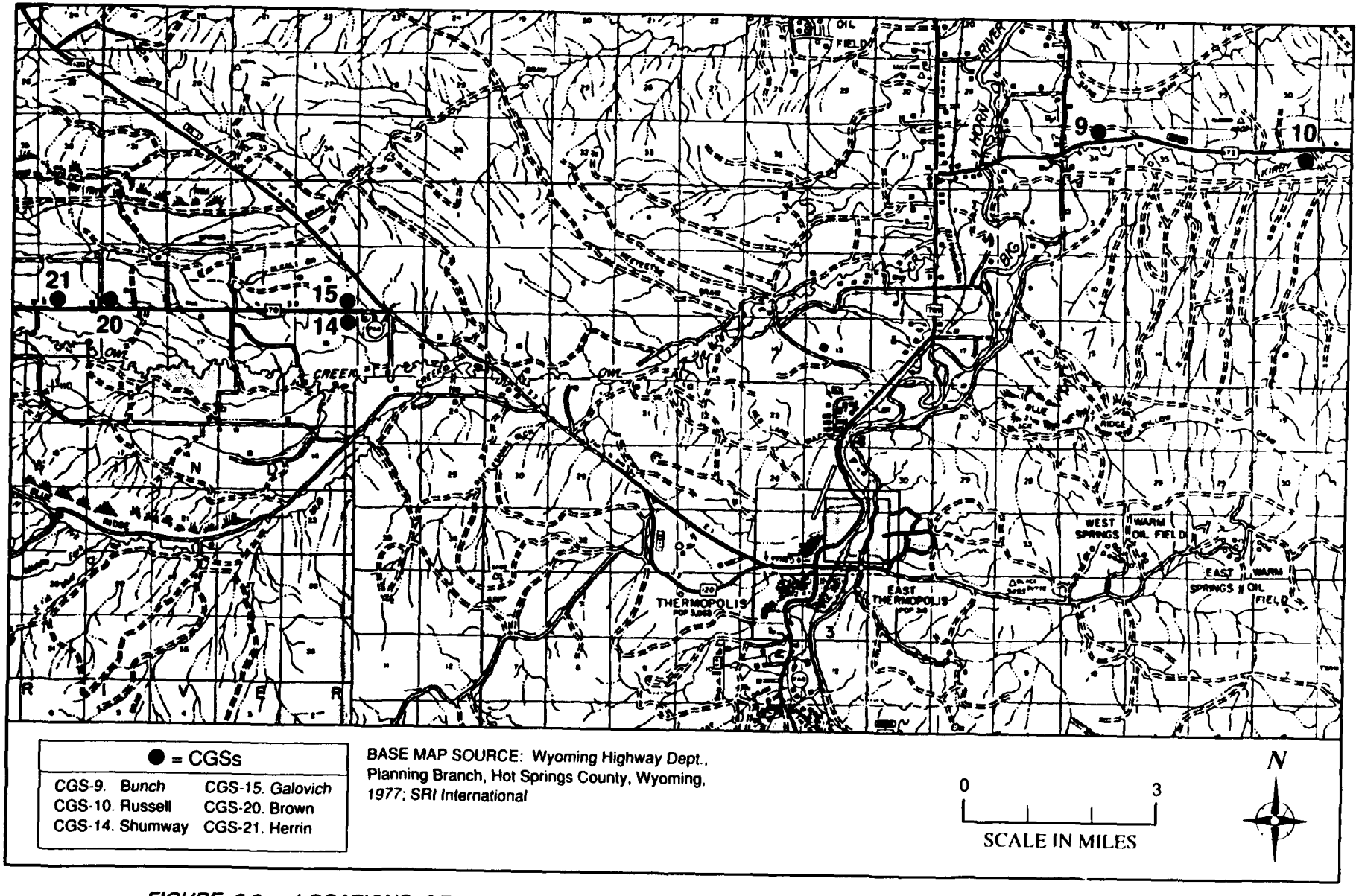

FIGURE 2.2 LOCATIONS OF CANDIDATE GWEN SITES (CGSs) IN HOT SPRINGS COUNTY, WYOMING

Phase 2, regional screening, involved the application of exclusionary and evaluative criteria to the SSA to identify areas that might contain operationally acceptable sites outside environmentally sensitive areas. The resulting search areas, called potential areawide sites (PAWS), were submitted to appropriate federal, state, and local officials for review. The PAWS were then redefined, as appropriate, by incorporation of the comments of the reviewers, and a field investigation was conducted to find suitable candidate sites for a GWEN relay node within the redefined PAWS.

A field investigation for central Wyoming was conducted in April 1990. Twenty-one sites were identified during automobile-based surveys as potential candidate GWEN sites (PCGSs). Three of the sites and part of a fourth were located outside of the SSA because of a scarcity of three-phase power and all-weather roads within the SSA. The sites identified outside the SSA were evaluated under the same FEIS siting criteria as the sites within the SSA. Attempts were made to contact the owners of the sites to determine their interest in selling or leasing land to the Government. Rights-of-entry were granted to investigate eight PCGSs. An additional four sites, under the jurisdiction of the Bureau of Land Management (BLM), did not require signed rights-of-entry. Following evaluation against the environmental siting criteria set forth in the FEIS, six of the twelve PCGSs were recommended as CGSs for further review.

Phase 3, individual site evaluation, of which this EA is a part, is then used to determine the relative suitability of the candidate sites through site-specific technical studies. This EA presents the results of the environmental portions of those studies and covers site-specific impacts associated with construction of a relay node in central Wyoming. These are summarized in Sections 4.2 through 4.7 of this EA. The findings of this EA and site-specific studies of operational parameters will be used to select a preferred GWEN site (PGS).

2.1.2 Relay Node Construction and Operation

A typical relay node site is located on approximately 11 acres of land (see Figure 2.3 of this EA). It is an unmanned facility consisting of a 299-foot-tall, three-sided, 2-foot-wide, LF transmitter tower, three equipment shelters, an access road, and associated fences. The tower has a base insulator and lightning protection and is supported by 24 guy wires, including 12 top-loading elements to further strengthen the signal and provide additional structural support.

These guy wires and top-loading elements are attached to the tower and 18 buried concrete anchors. The sizes of these anchors and their depth of burial varies with local soil and bedrock properties. However, the guy-wire anchors typically are rectangular blocks buried 5 feet below the surface. If bedrock occurs at or near the surface, the anchors are special rock-embedded rods. The tower base is concrete with a cross-section area resembling an inverted T. The size of this foundation is determined by soil conditions.

A radial ground plane, composed of 100 buried copper wires, extends out from the base of the tower. Each wire is 0.128 inch in diameter, about 330 feet long, and buried approximately 12 inches underground. The ground plane helps to strengthen the broadcast signal, and the number and length of the wires depend on the soil conductivity at the site. A 4-foot-high fence is installed around the perimeter of the ground plane to protect the ground plane and guy anchors and to prevent inadvertent exposure to electric shock resulting from the buildup of static electric charge.

In addition to the main tower, the relay node has two other antennas. One is an LF receive antenna made up of a pair of 4-foot-diameter rings mounted on a 10-foot pole. The second is an ultrahigh-frequency (UHF) antenna used for communicating with airborne input/output terminals. It is a 9-foot-high whip-like antenna mounted on a 30-foot-high pole. Both antennas are located within the equipment area at the perimeter of the site, which is enclosed by an 8-foot-high fence.

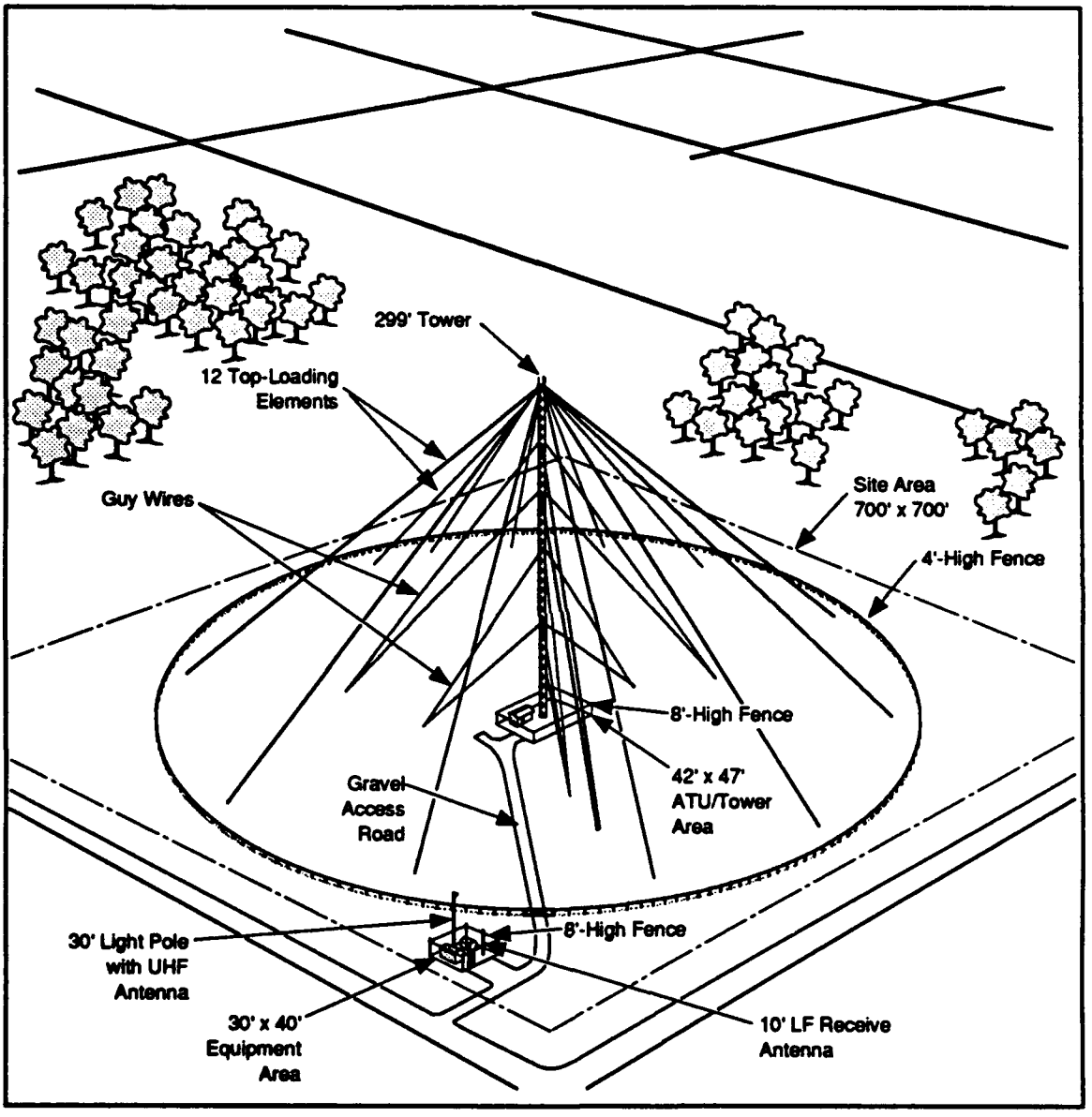

FIGURE 2.3 TYPICAL LAYOUT OF FOC RELAY NODE STATION

The siting and design of the tower are coordinated with the Federal Aviation Administration (FAA) to ensure compliance with FAA standards and regulations. The tower is equipped with a white strobe light at the top, which emits 40 flashes per minute and is rated at 20,000 candelas for daytime and twilight use and 2,000 candelas for nighttime use. To minimize glare at ground level, the light is focused upward and horizontally outward.

GWEN operates intermittently in the LF radio band at 150 to 175 kilohertz (kHz). For comparison, the low end of the AM band for commercial broadcasts is 530 kHz. The peak broadcast power for each GWEN tower is from 2,000 to 3,000 watts, depending on local soil conditions. In its ready status, GWEN typically transmits for a total of 6 to 8 seconds per hour. GWEN does not interfere with commercial television, radio broadcasts, amateur radio operations, garage door openers, or pacemakers, as noted in Section 2.1.1.1, page 2-3 of the FEIS.

All equipment shelters are anchored to concrete pads. One shelter, located at the base of the tower, houses the antenna tuning unit (ATU). Two other shelters are located side by side in the equipment area enclosed at the perimeter of the property. One houses radio-processing equipment, and the other houses a 70-horsepower, back-up diesel generator and two aboveground fuel tanks. The generator operates 2 hours per week for testing purposes and during power outages. Locked, 8-foot-high chain link fences topped with barbed wire secure the equipment shelter areas at the base of the tower and at the perimeter of the site to provide safety and to inhibit unauthorized entry. A 12-foot-wide gravel road provides access to the equipment area enclosure at the perimeter of the property. A 10-foot-wide gravel road leads from the equipment enclosure to the tower.

Fuel is stored in two aboveground steel tanks inside the generator shelter. Tank capacities are 559 gallons and 461 gallons. Each tank pipes fuel separately to the back-up power group (BUPG) and is equipped with two outlet shut-off valves, one controlled manually and one controlled automatically. If a leak occurs, fuel will flow into a floor drain leading to a tightly capped pipe extending outside the BUPG. Once approximately 2 gallons of fuel accumulate in the pipe, a "liquid spill" signal is sent to the GWEN Maintenance Notification Center, which will dispatch maintenance personnel. However, if

a leak were not detected, an explosion inside the shelter would be extremely unlikely due to the high flash point of diesel fuel. If a tank at the GWEN station failed, the entire contents of one tank could be released and contained inside the BUPG shelter. Refer to Section 4.12.1.1, beginning on page 4.12-1 of the FEIS for further discussion on diesel fuel spills and leaks.

The station uses existing commercial three-phase electric power and telephone service, but does not require water, septic, or sewer systems. Power and telephone service are brought to the site through either overhead or buried lines depending on local utility practices. Power and telephone service are generally brought underground from the site boundary to the equipment shelter area.

Temporary increases in air pollutant emissions will occur during construction, primarily from greater use of heavy machinery than is required in normal farming operations. Emissions resulting from operations of the facility will be limited to the operation of the BUPG, which will operate only 2 hours every week for testing purposes and for additional periods as required during power outages. Thus, the generator will operate for a total of 152 hours per year, if commercial power outages totaled 48 hours. If the generator runs at 100 percent load during the projected 152-hour operating time, total emissions in one year will be less than 350 pounds per pollutant, as documented in Section 4.3.1, beginning on page 4.3-1 of the FEIS.

Noise levels generated by construction equipment are discussed in Section 4.5.1.1, beginning on page 4.5-1 of the FEIS. Under worst-case assumptions, levels could reach 78 dBA at the site boundary from on-site activity and 92 dBA at distances of 50 feet from equipment installing the off-site access road. Noise generated during GWEN operation would come from the BUPG, which will operate only 2 hours per week and during commercial power outages. The BUPG will be located at least 50 feet within the site boundary with its exhaust side oriented toward the tower area. Noise levels due to intermittent operation of the BUPG will be less than 72 dBA at the site boundary, which is within the standards typically set for lands under agricultural use (70 to 75 dBA). At 50 feet beyond the site boundary, the noise level would drop below 65 dBA, which is within the standards typically set for residential and mixed residential/agricultural use (55 to 65 dBA).

These noise levels and standards are discussed in Section 3.5.3, page 3.5-2 and Section 4.5.1, pages 4.5-1 through 4.5-6 of the FEIS.

Construction will require as many as 20 workers at any given time and take about 6 weeks. Standard earth-moving and erection equipment will be used, as detailed in Table 2-1, page 2-14 of the FEIS. Erosion control techniques that are consistent with local practices will be used during construction. For any one of the action alternatives, vegetation removal and grading will be minimal, and the site will be replanted after construction is finished.

After construction is completed, personnel requirements will be limited to periodic maintenance by a contractor who will service the equipment, cut the surface growth, remove snow from the access road, and perform other services, as needed. Security services will be arranged with local authorities. The projected life of the facility is 15 to 25 years. Upon decommissioning, the tower and other structures will be removed, as discussed in Section 2.1.4, page 2-18 of the FEIS.

2.2 Alternative 1: Bunch Site (CGS-9)

The Bunch site, in the northeastern portion of the SSA, is 115 feet north of State Highway 172 (Black Mountain Road) and 0.5 mile east of Lower East River Road, in the northwest quarter of the northeast quarter (NW1/4 NE1/4) of Section 34, Township 44N, Range 94W. A 115-foot access road would be required from State Highway 172 via an existing ranch road that would be upgraded.

Three-phase power would be obtained from overhead lines along Lower East River Road, 0.5 mile west of the site. Telephone lines would be connected to an underground cable 200 feet south of the site, across State Highway 172.

Appendix B, Figure B.1 of this EA, provides a map showing the surrounding topography.

2.3 Alternative 2: Russell Site (CGS-10)

The Russell site, outside the SSA to the northeast, is 460 feet south of State Highway 172 and 3.85 miles east of the intersection of State Highway 172 and Lower East River Road, in the SE1/4 NE1/4 of Section 31, Township 44N, Range 93W. The 460-foot access road would be from State Highway 172 via an existing ranch road that would be upgraded.

Three-phase power would be obtained from overhead lines 60 feet north of the site. Telephone lines would be connected to an underground cable 365 feet north of the site, on the south side of State Highway 172.

Appendix B, Figure B.2 of this EA, provides a map showing the surrounding topography.

2.4 Alternative 3: Shumway Site (CGS-14)

The Shumway site, in the northwestern portion of the SSA, is 240 feet south of State Highway 170 (Hamilton Dome Road) and 0.5 mile west of the intersection of State Highways 170 and 120 (Meeteetse Highway), in the NE1/4 NE1/4 of Section 15, Township 43N, Range 96W. The 240-foot access road would be from State Highway 170 via an existing road that would be upgraded.

Three-phase power would be obtained from overhead lines 200 feet north of the site, just south of State Highway 170. Telephone lines would be connected to an underground cable 355 feet north of the site, across State Highway 170.

Appendix B, Figure B.3 of this EA, provides a map showing the surrounding topography.

2.5 Alternative 4: Galovich Site (CGS-15)

The Galovich site, on the northwestern boundary partially outside the SSA, is 90 feet north of State Highway 170 and 0.5 mile west of the intersection of State Highways 170 and 120, in the SE1/4 SE1/4 of Section 10, Township 43N, Range 96W. A 90-foot access road would be required from State Highway 170.

Three-phase power would be obtained from overhead lines 155 feet south of the site, across State Highway 170. Telephone lines would be connected to an underground cable adjacent to the southern boundary of the site.

Appendix B, Figure B.4 of this EA, provides a map showing the surrounding topography.

2.6 Alternative 5: Brown Site (CGS-20)

The Brown site, outside the SSA to the northwest, is 42 feet north of State Highway 170 and 17 feet east of North Owl Creek Road, in the SW1/4 SW1/4 of Section 7, Township 43N, Range 96W. The 42-foot access road would be from State Highway 170 via an existing road that would be upgraded.

Three-phase power would be obtained from overhead lines 100 feet south of the site, across State Highway 170. Telephone lines would be connected to an underground cable adjacent to the southern boundary of the site.

Appendix B, Figure B.5 of this EA, provides a map showing the surrounding topography.

2.7 Alternative 6: Herrin Site (CGS-21)

The Herrin site, outside the SSA to the northwest, is 218 feet north of State Highway 170 and 0.6 mile west of North Owl Creek Road, in the SE1/4 SW1/4 of Section 12, Township 43N, Range 97W. The access road would be from State Highway 170 and would be 218 feet long.

Three-phase power would be obtained from overhead lines adjacent to the eastern border of the site. Telephone lines would be connected to an underground cable 200 feet south of the site, on the north side of State Highway 170.

Appendix B, Figure B.6 of this EA, provides a map showing the surrounding topography.

2.8 No Action Alternative

The no action alternative is deletion of the central Wyoming relay node from the GWEN network. Adoption of this alternative would mean a consequent degradation in the performance of the system due to a lack of connectivity to the other nodes in the system.

3.0 AFFECTED ENVIRONMENT

This section discusses the environmental setting of the proposed GWEN project in central Wyoming. Section 3.1 of this EA describes the general characteristics of the SSA, and Sections 3.2 through 3.7 of this EA describe the unique characteristics of each CGS within the SSA. Site descriptive data was obtained during field investigations conducted in April 1990. U.S. Geological Survey 7.5 minute topographical maps were used as data sources for distances, physiographic features, and topography (USGS, 1960a-d, 1965a-d, 1985a-c).

3.1 Site Search Area

Presented below is information on the physical, biological, and socio-cultural setting of the SSA.

3.1.1 Physical Setting

The SSA in central Wyoming is a circular, 250-square-mile area in Hot Springs County, centered 0.2 mile southeast of the town of Thermopolis in the central portion of the Rocky Mountain physiographic province of the United States. The SSA is in the southernmost part of the Big Horn Basin. The major topographic features within the county include the Owl Creek Mountains, Wind River Canyon, and Cedar Mountain. The Owl Creek Mountains, which border the SSA on the south and are snowcapped for most of the year, join the Absaroka Mountains to the west of the SSA. The Wind River Canyon, bisecting the southern portion of the SSA, is a 2,000-foot-deep chasm cut by the Wind River through the Owl Creek Mountains. Cedar Mountain is a large slanting butte northeast of the SSA. The CGSs northeast of Thermopolis are in the Kirby Creek drainage basin and are flanked by low rolling hills and drainageways that gradually ascend to higher ridges. The CGSs northwest of Thermopolis are on a broad valley floor north of Owl Creek, with Padlock Rim on the north and Blue Ridge on the south (Arthur, 1991). Other topographic features within the project area include volcanic remains to the north and east of Thermopolis and various ridges and buttes throughout the area.

The mountains are structurally complex uplifts of folds, faults, and batholiths, characteristic of the central Rocky Mountains. These anticlinal ranges are separated by low-lying basins. Batholiths, caused by solidification of volcanic magma beneath the earth's surface, comprise the central core of the mountain ranges (Love and Christiansen, 1985). The bedrock formations of the CGSs are weathered exposures of Cody shale from the Late Cretaceous period (formed 66 million to 96 million years ago) and alluvium and colluvium from the Quaternary period (formed 0 to 2 million years ago). Only one site —the Galovich site (CGS-15)—is on the Cody shale formation; all other CGSs are on alluvium and colluvium (Breithaupt, 1990b).

Historically, seismic activity in the vicinity of the SSA has included a number of moderately strong earthquakes. Within a 50-mile radius of the SSA center, thirteen earthquakes with Modified Mercalli (MM) intensities ranging up to V have occurred since 1928. That includes three earthquakes centered 3 miles south of the SSA center in 1954, one centered 6 miles southwest in 1972, and one centered 6 miles northwest in 1928 (Howard *et al.*, 1978; Kinney, 1966; Stover, 1986). This historic seismic activity indicates that the SSA could be affected by a moderately strong earthquake with an MM intensity of V or less. An earthquake of this magnitude would not be strong enough to cause substantial damage to well-built structures. However, surface ground rupture along an active fault zone could damage structures constructed over the fault. Areas containing active or potentially active faults have therefore been avoided, and the level of seismic hazard to GWEN facilities is very low (Manitakos, 1989).

Mineral resources within the SSA include several oil fields in the eastern portion of the county and one in the north (Marrel, 1990). All of these oil fields are at least 4.5 miles from the nearest CGS. Several gravel pits also occur in the SSA (Hannum, 1990).

The Wyoming Geological Survey recommended that all CGSs be surveyed for paleontological resources, since portions of the sites on the Cody shale formation potentially contain vertebrate fossils from the Late Cretaceous period (Breithaupt, 1990a). The proposed GWEN sites were surveyed for fossils on November 11 and 12, 1990, by a professional paleontologist traversing the sites on foot in search of exposures of rock and

associated fossils. Only the Galovich site (CGS-15), located on weathered exposures of Cody shale, yielded fossils, but these were fossilized remains of invertebrates. These remains are discussed in Section 3.5 of this EA.

The soils of the SSA, formed from the weathering of shale and sandstone bedrock, all have generally level to moderate slopes. These soils range from poorly drained to well drained and are neutral to strongly alkaline, with pH values ranging from 6.6 to 9.0. Three of the CGSs contain soils that have a depth to the seasonally high water table of less than 4 feet; soils on the other three have a depth to the seasonally high water table of greater than 6 feet. Four sites have soils that are highly erodible. Although the Soil Conservation Service (SCS) list of hydric soils of the United States does not designate any of the soils on the CGSs as hydric (SCS, 1987), the Hot Springs County district SCS has determined that soils on five of the sites are hydric (SCS, 1990). None of the soils is considered prime farmland (SCS, 1990). The specific soils on each CGS are discussed in Sections 3.2 through 3.7 of this EA.

The Big Horn and Wind rivers—the SSA's major perennial waterways—run from south to north through the center of the SSA. The Wind River enters from the south and joins the Big Horn at the Wedding of the Waters 4 miles south of Thermopolis. The Big Horn River then continues northward toward the Yellowstone River. On the average the Big Horn River is 300 feet wide, and its floodplain ranges from 150 feet to approximately 0.75 mile. Other perennial streams in the SSA are Owl Creek, which flows from the west and joins the Big Horn River about 5 miles north of Thermopolis, and Mud Creek, which flows from the southwest and joins Owl Creek about 1.5 miles from the intersection of State Highways 120 and 170 in the northwestern portion of the SSA. Owl Creek forms part of the northern border of the Wind River Indian Reservation. Many smaller, intermittent streams, including Kirby Creek in the northeastern portion of the SSA, drain toward the Big Horn River. None of the sites are in the 100-year floodplains bordering these rivers and streams (FIA, 1986). All of the CGSs except the Bunch site (CGS-9) are within 300 feet of surface water. The distances from each CGS to the nearest surface water or wetlands are given in Sections 3.2 through 3.7 of this EA.

Hot Springs County does not have a good supply of high quality groundwater. Because of the mineral springs in the area, the groundwater contains high mineral concentrations of sulfur and selenium (Harmon, 1990). Therefore, water for residential and industrial use comes from the Big Horn River and is treated in Thermopolis to reach Wyoming drinking water standards (Williams, 1990).

The climate of the SSA is characterized by dry air, sunny days, clear nights, low to moderate precipitation with high evaporation, and extreme daily temperature changes. Temperatures average 70°F in the summer, reaching highs of 100°F; in the winter the average is 20°F, with lows reaching -44°F. The frost-free season typically extends from May to September, providing a 100- to 130-day growing season. Annual precipitation ranges from 10 to 17 inches, depending on elevation. Approximately 70 percent of the total annual precipitation occurs during the growing season (USDA, 1941).

Air quality in the SSA is good and does not exceed the National Primary or Secondary Ambient Air Quality Standards, which the State of Wyoming has adopted (Wyoming Environmental Quality Act, 1990; Wyoming Statutes 35-11-202). Violations of the standards for total suspended particulate concentrations are the most common deviations, but they occur only near the state's larger cities such as Cheyenne and Laramie. The BUPG will require a permit from the Wyoming Division of Air Quality (Fauth, 1991). Air quality standards are discussed in Section 3.3.3, pages 3.3-1 to 3.3-7 of the FEIS.

3.1.2 Biological Setting

Shrubs are the dominant vegetation of the SSA's sagebrush ecosystem. These shrubs, principally of the genus *Artemisia*, are usually 1 to 7 feet high. Other shrubs, such as greasewood, saltbush, mountain juniper, ash, honey locust, sumac, and ponderosa pine, also grow in the area. Local grasses and forbs include blue grama, green needlegrass, needle and thread grass, little bluestem, wheatgrass, alkali bluegrass, alkali cordgrass, alkali sacaton, Indian ricegrass, basin wild rye, thread leaf sedge, side oats grama, and milk vetch (SCS, 1990).

The SSA contains an abundance of free-grazing wildlife, including the pronghorn, mule and white-tailed deer, and elk (Fralick, 1990a). Other common mammals include the badger, river otter, coyote, swift fox, mountain lion, white-tailed prairie dog, black bear, red squirrel, Wyoming pocket mouse, porcupine, desert cottontail rabbit, and bobcat (Burt, 1952). Game birds that have been observed on the CGSs include the gray partridge, sage grouse, and ring-necked pheasant (Fralick, 1990b).

The *Federal Manual for Identifying and Delineating Jurisdictional Wetlands* (GPO 1989-236-985/00336) states that an area must meet three criteria to be designated as wetland: hydric soils; hydrophytic vegetation; and wetlands hydrology, which includes a shallow water table and standing water for at least 7 days of the growing season (FICWD, 1989). This manual was used as the basis for wetland determination. Because the district SCS determined that some of the CGSs contain hydric soils and have a depth to the seasonally high water table of less than 4 feet (SCS, 1990), the U.S. Army Corps of Engineers (COE) conducted an on-site survey of all the CGSs to delineate wetland areas. This survey was conducted during two visits to the CGSs, on October 23 and November 13, 1990 (Appendix C, Bilodeau, 1991, pages C-12 through C-14 of this EA). Only portions of the Galovich (CGS-15) and Brown (CGS-20) sites meet all three wetlands criteria, as discussed in Sections 3.5 and 3.6 of this EA. A potential wetland area occurs along the intermittent tributary of Alkali Draw just beyond the eastern border of the Shumway site (CGS-14); livestock have eaten the vegetation to the extent that a determination of hydrophytic vegetation could not be made at the time of the COE survey. The remaining three CGSs do not have wetlands on or within 300 feet of the site (Appendix C, Bilodeau, 1990, pages C-10 and C-11 of this EA).

No wildlife refuges, preserves, or sanctuaries exist within the SSA. Areas along Wind River Canyon and the Big Horn River serve as avian flyways for water birds such as the Canada goose, mallard, and northern pintail; for raptors such as the turkey vulture, Cooper's hawk, and red-tailed hawk; and for passerines such as the barn swallow, blue jay, and American robin. Sandhill cranes and winter migrating bald eagles have been observed along this flyway (Fralick, 1990a), as well as trumpeter swans and peregrine falcons (Hurley, 1990).

In compliance with Section 7 of the Endangered Species Act of 1973 as amended (16 United States Code [USC] 1531, *et seq.*, at 1536), a list of threatened and endangered species was obtained during informal consultations with the U.S. Fish and Wildlife Service (USFWS) (Appendix C, Starkey, 1990, pages C-4 and C-5 of this EA; Appendix C, Davis, 1992, 1993, pages C-15 through C-18 of this EA). According to the latest list, three federally listed threatened or endangered species and seven candidates for federal listing could reside in or migrate through the SSA. The three threatened or endangered species are the black-footed ferret (*Mustela nigripes*), the bald eagle (*Haliaeetus leucocephalus*), and the peregrine falcon (*Falco peregrinus*). The candidates for federal listing are the ferruginous hawk (*Buteo regalis*), the loggerhead shrike (*Lanius ludovicianus*), the mountain plover (*Charadrius montanus*), the white-faced ibis (*Plegadis chihi*), the long-billed curlew (*Numenius americanus*), the black tern (*Chlidonias niger*), and the Sturgeon chub (*Hybopsis gelida*).

The black-footed ferret is a weasel-like mammal that feeds on white- and black-tailed prairie dogs and is generally found in or near large prairie dog towns (BLM, 1985). A survey of the CGSs in September 1990 determined that the Shumway (CGS-14) and Herrin (CGS-21) sites contain prairie dog colonies and therefore represent potential black-footed ferret habitat. A professional biologist surveyed these two colonies on three consecutive nights, October 17 to 19, 1990, and observed no black-footed ferrets. Based on favorable sighting conditions and thorough coverage during the survey, it was determined that no black-footed ferrets were present (BRC, 1990a, 1990b).

The bald eagle is primarily associated with riparian areas such as coasts, rivers, and lakes and usually nests and feeds near large bodies of water. Although the bald eagle is an opportunistic feeder and will take a variety of vertebrate prey, fish comprise the major part of its diet (Ehrlich *et al.*, 1988; BRC, 1990a). The bald eagle nests and forages in the riparian habitat along the Big Horn River near Thermopolis (Fralick, 1990a; Appendix C, Davis, 1993, pages C-16 through C-18 of this EA). The Big Horn River is 1.5 miles from the nearest CGS, and an on-site biological assessment determined that the CGSs are not located within important bald eagle habitat or within identified migration corridors (BRC, 1990a).

The peregrine falcon, a predator of other birds, is generally associated with wetlands and open areas, such as cropland and grassland, although it nests on cliffs (Ehrlich *et al.*, 1988; BRC, 1990a). Although the riparian habitat along the Wind and Big Horn rivers could attract peregrine falcons, an on-site biological assessment determined that the CGSs are not located within important peregrine falcon habitat or within identified migration corridors (BRC, 1990a).

The ferruginous hawk is a species of semi-arid lands, primarily semi-arid grasslands. The hawk specializes in hunting rodents and rabbits, only occasionally taking birds or reptiles. Its preferred nesting sites are junipers at the interface of pinyon-juniper and desert shrub communities. Its hunting patterns vary but emphasize short or low flights. Its usual hunting pattern involves low flights over open ground in which the bird flaps its wings several times and then glides, although it occasionally hunts by hovering and on rare occasions by soaring (Herron *et al.*, 1985). It also forages from perches or from flight altitudes up to 100 meters above the ground (Johnsgard, 1990). Breeding habitat is absent from the CGSs, all of which lack trees and are covered with native vegetation of sagebrush, greasewood, saltbush, opuntia, and scattered grasses. However, the hawk could forage on the CGSs.

The loggerhead shrike is found throughout the United States in a variety of habitats, primarily open country with sparse vegetation of low shrubs and herbs. It prefers areas with nearby perching sites such as fences, woody vegetation, or hedgerows. It forages for insects, small mammals, and small birds using short, straight flights from these perches (Ehrlich *et al.*, 1988; Ransom, 1981). Shrikes nest near water, and breeding pairs occupy areas of 13 to 40 acres although solitary birds probably defend somewhat smaller territories (Jaeger, 1961). It forages in northern California and adjacent areas from March through October and overwinters in the southern United States and areas further south. It breeds in April, May, and June (Thomas, 1979). Although breeding habitat is absent from the CGSs, foraging habitat is present on all of the CGSs.

The mountain plover is a gregarious species of dry fields, plains, prairies, and grassy deserts. Its nests are typically on flat ground between grass hummocks but will occasionally be found among cacti or scattered shrubs. Often located near old cow

droppings, the nests are lined with cow chips, rootlets, and grasses. Insects are the principal prey of this species, which forages by gleaning. It relies on cryptic coloration and motionlessness rather than flight for protection (Ehrlich *et al.*, 1988; Ransom, 1981). Plover habitat is present on all the CGSs.

The white-faced ibis is a wetlands species found mostly within freshwater habitats. It migrates seasonally, breeding in the eastern United States and overwintering in South America. Nests are usually on the ground in wetlands and are aggregated in small clusters. The diet is based primarily on aquatic invertebrates, wth secondary contributions from insects and small vertebrates (Ehrlich *et al.*, 1988). Prime breeding and foraging habitats for this species are absent from the CGSs, although the ibis might occasionally forage in the small, seasonal wetlands on or near three of the CGSs (CGSs-14, -15, and -20).

The long-billed curlew is the largest of the North American shorebirds, formerly found in the west from southern Canada to Texas. It breeds in prairies and grassy meadows, usually near water. It nests in damp, grassy hollows or on slopes; it roosts along the coast, on small, sandy islands offshore, at the edges of ponds, or on prairies. It frequents beaches and mudflats south to Central America during the winter but will forage in uplands also (Ehrlich *et al.*, 1988; Terres, 1980). Prime breeding and foraging habitats for this species are absent from the CGSs, although the curlew might occasionally forage in the small seasonal wetlands on or near three of the CGSs (CGSs-14, -15, and -20).

The black tern is an insectivorous species that nests in marshes, sloughs, and wet meadows. It forages in open meadows, marshes, and freshly plowed fields, frequently following the plow (Ehrlich *et al.*, 1988). Prime breeding and foraging habitat for this species is absent from the CGSs, although the tern might occasionally forage in the small seasonal wetlands on or near three of the CGSs (CGSs-14, -15, and -20).

The Sturgeon chub is a plain-colored minnow approximately 3 inches long as an adult. It is restricted to shallow, fast riffles over fine gravel or coarse sands in large rivers (Smith, 1979). Its habitat is absent from the CGSs.

The State of Wyoming does not have an official list of protected species, but the Wyoming Department of Game and Fish maintains a list of nongame bird and mammal species in need of special management. None of these species would be affected by the GWEN project (Ritter, 1990).

3.1.3 Socio-Cultural Setting

Human activity began in the Big Horn Basin as early as 11,800 years ago, as evidenced by Paleo-Indian mammoth kill sites, such as the Colby site near Worland, 30 miles north of the SSA. Big game hunting and vegetable gathering were the economic mainstays of these nomadic bands as they followed the seasonal patterns of available resources from the basins to the uplands and back. From about 2,000 years ago until the arrival of Euro-Americans, mobile bands of Shoshonean speakers utilized the Big Horn Basin and the area around Thermopolis, as well as the mountains and basins to the south and west (Arthur, 1991).

The earliest documented Euro-American exploration of the Big Horn Basin was John Colter's early 1800s expedition, which probably did not reach as far south as the project area. An influx of Euro-Americans began in 1822 when Alexander Henry of the American Fur Company and William Ashley of the Rocky Mountain Fur Company joined to organize fur trapping throughout the mountains in Idaho, Montana, Wyoming, Utah, and Colorado. By 1840 the fur trade was dwindling and activity in the area dropped, but the discovery of gold in the 1860s brought an influx of miners (Arthur, 1991).

By 1866, troubles between the Native Americans and miners streaming into northern Wyoming and eastern Montana necessitated establishment of the Bozeman Trail and its protective forts. Because Native American conflicts were less intense in the Big Horn Basin than along the Bozeman Trail in the 1860s, Jim Bridger proposed an alternate route. The Bridger Trail entered the area of the SSA along Kirby Creek and then turned north at the Big Horn River; it was longer and rougher than the Bozeman Trail, but it was safer (Arthur, 1991).

Documented interest in the actual project area began with the formation of the Wind River Indian Reservation by the Treaty of 1868. In negotiating this treaty, signed at Fort Bridger by General Auger and Shoshoni Chief Washakie, the Government bargained with Washakie to move his tribe to the Wind River Valley from the Bridger Valley area in southwest Wyoming to allow the railroad to pass through. The reservation was occupied solely by the Shoshoni until 1878, when Chief Washakie allowed the Government to relocate the Arapaho there for the winter of 1878-1879. The Arapaho were never removed from the reservation, and the two tribes, traditional enemies, lived together with considerable ill will. The Shoshoni brought suit against the Government and, in a 1938 settlement, received $4 million for the lands occupied by the Arapaho (Arthur, 1991).

The homestead era began in 1871 when John Woodruff built a cabin on Owl Creek. Subsequent to this, however, homesteading languished because access to the area north of the Wind River Indian Reservation's Owl Creek boundary was difficult. The only way into the region was from the north, because rugged terrain blocked access from the south, west, and east. The Bridger Trail over Bridger Pass and down Kirby Creek was the most common approach. In 1896 about 55,000 acres of reservation land were ceded to the Government, including the Thermopolis area and land to be occupied by the Riverton Project, an irrigation and water development project aimed at establishing an agricultural base in the area. In March 1905 an Act of Congress opened 1.5 million acres of former reservation land to Homestead Act entries, and more than 10,500 applications were filed for 1,600 homestead tracts. Thousands of settlers arrived in the summer of 1906 to await the results of a drawing held to distribute the land. Agricultural pursuits blossomed after this, with the systems of ditches and canals that brought water from the Big Horn River allowing farmers to utilize the good soils and moderate temperatures. The raising of cattle, horses, and sheep became viable industries. The 1904 discovery of coal north of Thermopolis and oil east of town prompted new industries and their support facilities. The Hamilton Dome oil field, west of the SSA, was developed around 1918. Coal towns such as Gebo and Crosby, just north of the SSA, employed and housed hundreds of miners until the 1930s, when the mines were finally shut down (Arthur, 1991).

Hot Springs County was created in 1911, with Thermopolis as the county seat. The original townsite was north of current Thermopolis at the mouth of Owl Creek. The town was moved to its present site after a 1904 treaty with the Shoshoni opened the northeast corner of the Wind River Reservation for settlement. The county took its name from the hot mineral springs just north of present-day Thermopolis. These springs are fed by water from the surrounding mountains that percolates into an artesian basin and then bubbles to the surface. Settlement was not allowed in the area around the springs, which had been, from early times, a tourist attraction, and a square mile around the springs eventually became Hot Springs State Park (Arthur, 1991).

The railroad reached Thermopolis from the north in 1910 and was extended through the Wind River Canyon by 1913. The first road through the canyon was built in 1924. Thermopolis then had access from both north and south, and these transportation routes enabled easy shipment of stock, agricultural products, coal, and oil to outside markets (Arthur, 1991).

As required by the National Historic Preservation Act (16 USC 470, *et seq.*), the Wyoming State Historic Preservation Officer (SHPO) was consulted regarding cultural resources. The Wyoming SHPO recommended that a cultural resources survey be conducted to identify potential archaeological resources and historic structures (Appendix C, Marceau, 1990, page C-7 of this EA). The Wyoming SHPO review agency in the Wyoming Department of Commerce clarified this recommendation with the request for a Class III cultural resources survey, which includes a literature search, an on-site archaeological survey, and an historic structures survey (Appendix C, Bryant, 1990, page C-9 of this EA).

A literature search of the Wyoming State Archives, Museums and Historical Department, was conducted in September 1990 to identify previous surveys of the CGSs and areas within 1.5 miles of each CGS. Besides the Bridger Trail, no other properties in the survey area are considered eligible or potentially eligible for listing on the NRHP. No evidence of the Bridger Trail, which is considered NRHP-eligible, was identified, and the portions of a possible route that were examined had been subjected to recent grading. The trail, scouted by Jim Bridger as an alternative to the Bozeman Trail, began at present-day Casper, Wyoming. It entered the SSA on the northeast and ran along either the north or

south side of Kirby Creek to its juncture with the Big Horn River within the SSA. Only four parties used the Bridger Trail, all in the spring of 1864. No evidence of the actual trail exists, although several possible routes have been proposed within the general area of Kirby Creek. After the trail was abandoned in 1864, portions of it may have served as local travel routes. The trail noted on the 1893 Government Land Office plat probably follows the general route, if not the exact trail, and provided access up and down Kirby Creek for homesteaders east of the Big Horn River. The trail is more likely to have been on the south side of the creek than on the north, since the floodplain on the south is wider and probably easier to cross in a wagon. It is possible, however, that State Highway 172, on the north side of Kirby Creek, overlies the trail (Arthur, 1991).

In September 1990, an on-site archaeological survey was conducted on the six CGSs. Each site was surveyed by a professional archaeologist qualified in the State of Wyoming using pedestrian transects at 20-meter (approximately 66-foot) intervals. The CGSs are all in areas of marked exposure and are removed from water, riparian zones, and topographic features that would have made them attractive for prehistoric occupation. No archaeological resources were identified on any of the six CGSs (Arthur, 1991).

For reasons discussed in Section 4.8.1.3, beginning on page 4.8-2 of the FEIS and Section 4.1.3 of this EA, historic properties that occur within 1.5 miles of a CGS are potentially subject to adverse visual impacts from the relay node facility. In September 1990, an historic structures survey was conducted on areas within 1.5 miles of all six CGSs. No properties in the survey area are considered potentially eligible for listing on the NRHP. The portion of the Bridger Trail that may occur within 1.5 miles of the Bunch (CGS-9) and Russell (CGS-10) sites has not been mapped, although the most likely location for the trail is south of Kirby Creek. This potential trail segment is not likely to contribute to the overall significance of the Bridger Trail, because no evidence of the trail was identified and recent grading has compromised the integrity of this potential route (Arthur, 1991).

In compliance with the American Religious Freedom Act of 1978 (42 USC 1996), the Shoshoni Business Council, the Arapaho Business Council, and the superintendent of the Wind River Agency branch of the Bureau of Indian Affairs were notified of the proposed

GWEN project and asked about the presence of any known traditional, religious, or sacred sites in the project area. No response was received from the Shoshoni Business Council. The Arapaho Business Council responded that they did not have any concerns regarding the project (Antelope, 1991). The Wind River Agency's Historic Preservation Officer determined that a GWEN tower on any of the CGSs would have no effect on the reservation's cultural resources (Nation, 1990).

Land use in the area is predominantly agricultural. The primary crops are hay, alfalfa, oats, and corn. In 1988 Hot Springs County had 141 farms, which represented 1,056,000 acres. Approximately 30 percent of this acreage was cropland (Census Bureau, 1988), and much of the remainder was used as rangeland for livestock. Outside of Thermopolis, the density of residences is low, about two to three houses per square mile. The BLM manages much of the land within the SSA (Tideman, 1990). All of the CGSs are zoned agricultural by the Hot Springs County Planning Commission (Williams, 1990).

The main north-south route through the SSA is U.S. Highway 20, which runs through the Wind River Canyon and follows the Wind and Big Horn rivers through Thermopolis. State Highway 120 enters the SSA from the northwest and terminates in Thermopolis. State Highway 172 enters the SSA on the northeast and follows Kirby Creek, terminating, like the creek, at the Big Horn River. These three are the county's only two-lane paved roads. The smaller roads tend to follow the paths that the creeks and draws have cut through the SSA's rugged topography (WHD, 1977).

Sources of ambient noise are limited primarily to the operation of farm equipment and traffic. As described in Section 3.5.3, beginning on page 3.5-1 of the FEIS, local ordinances typically set maximum noise level limits at 70 to 75 dBA for land under agricultural use; however, Hot Springs County does not have a local noise ordinance (Williams, 1990).

The population of Hot Springs County was 5,700 in 1988, with a per capita income of $9,837, as compared to a state per capita income of $9,653 (Rand McNally, 1990). In 1980 the county's civilian labor force numbered 2,611 and unemployment was 2.6 percent (Census Bureau, 1980a). The largest employee force is in the service industry, followed

by retail trade, mining, construction, manufacturing, public administration, agriculture, transportation and public utilities, finance/insurance/real estate, wholesale trade, and forestry and fishing (Census Bureau, 1980b). The only incorporated town in the project area is Thermopolis, with a population of approximately 4,000 (Rand McNally, 1990).

Recreational resources within the project area are primarily confined to the area along the Big Horn River, where hiking, canoeing, hunting, and fishing are popular (Roll, 1990). This river is 1.5 miles from the nearest CGS. Other recreational areas include Hot Springs State Park, a golf course, and a country club, all in the Thermopolis area and more than 6.5 miles from any CGS.

The visual setting in the SSA is rural in character. The rocky outcrops, canyons, and buttes are surrounded by rolling hills, and the red of the rock contrasts with the green of the vegetation. The overall appearance is of big sky and open space. Complexity of the skyline is generally moderate, as defined in Section 4.8.1.3, page 4.8-10 of the FEIS, with farmsteads and their associated buildings providing variation on a local level; the Owl Creek Mountains and Wind River Canyon provide variation on a regional level.

3.2 Alternative 1: Bunch Site (CGS-9)

The Bunch site is generally level with slopes of 0 to 2 percent. Soils on the site are Gloin loam and representatives of the Petrie-Helt complex, all moderately to strongly alkaline soils with pH values ranging from 7.9 to 9.0. Gloin loam has moderate to moderately slow permeability and a depth to the seasonally high water table of 3.5 to 5 feet. Petrie-Helt complex has moderately slow permeability and a depth to the seasonally high water table of greater than 6 feet. These soils have a minimal erosion hazard and are considered hydric by the Hot Springs County district SCS office (SCS, 1990).

The nearest surface water is Kirby Creek, approximately 400 feet south of the site. The Big Horn River, approximately 1.5 miles west of the site, is used by migratory waterfowl for feeding and resting (Hurley, 1990).

In an on-site survey, the COE determined that no wetlands are on or within 300 feet of the site (Bilodeau, 1990). The site is currently used as pasture for horses and sheep and is covered with native vegetation, including sagebrush, greasewood, saltbush, opuntia, and scattered grasses.

Thermopolis, the nearest residential community, is 8.5 miles southwest.

3.3 Alternative 2: Russell Site (CGS-10)

The Russell site is generally level, with slopes of 0 to 2 percent in all directions. Soils of the Cadoma-Thedalund-Epsie complex on the site are neutral to strongly alkaline (pH 6.6 to 9.0). Permeability is moderately slow, and the depth to the seasonally high water table is greater than 6 feet. The erosion hazard is minimal (Mischke, 1990). Cadoma-Thedalund-Epsie soils are considered hydric soils by the district SCS office (SCS, 1990).

The nearest surface water is an intermittent stream that touches the southeastern corner of the site and joins Kirby Creek, also intermittent, approximately 450 feet south of the site. The Big Horn River, approximately 5 miles west of the site, is used by migratory waterfowl for feeding and resting (Hurley, 1990).

In an on-site survey, the COE determined that there are no wetland areas on or within 300 feet of the site (Bilodeau, 1990). The site is currently used for cattle grazing and is covered with native vegetation including sagebrush, greasewood, saltbush, opuntia, and scattered grasses.

Thermopolis, the nearest residential community, is approximately 11 miles southwest.

3.4 Alternative 3: Shumway Site (CGS-14)

The Shumway site is generally level, with a slope of 0 to 2 percent. Soils on the site are Dobent loam, Shingle-Samday clay loam, and Ustic Torriorth. Dobent loam is mildly to strongly alkaline (pH 7.4 to 9.0), with moderately slow permeability and a depth to the

seasonally high water table of 1.5 to 3.5 feet. This soil occasionally floods and is considered a hydric soil by the district SCS office. The erosion hazard is minimal. Shingle-Samday clay loam is a highly erodible soil, neutral to strongly alkaline (pH 6.6 to 9.0), with slow to moderate permeability and a depth to the seasonally high water table of greater than 6 feet. Ustic Torriorth, a grouping of alluvial soils within riparian areas, has widely varying pH and permeability characteristics that have not been calculated. Ustic Torriorth soils are considered hydric by the district SCS office and are subject to occasional flooding; additionally, the seasonally high water table is at or near the soil surface. The erosion hazard is minimal (SCS, 1990).

The nearest sources of surface water are a man-made irrigation ditch that flows west to east through the CGS and an intermittent tributary of Alkali Draw that flows 200 feet from the eastern site boundary. The main body of Owl Creek, the nearest perennial stream, is approximately 1 mile south of the site, and the Big Horn River is approximately 9 miles east.

In an on-site survey, the COE determined that a potential wetland area occurs along the intermittent tributary of Alkali Draw, but livestock had eaten the vegetation to the extent that a determination of hydrophytic vegetation could not be made at the time of the survey (Bilodeau, 1990). The site was fallow at the time of the field investigation but has been leveled and tilled in the past; a small amount of native vegetation (sagebrush, greasewood, saltbush, opuntia, and scattered grasses) still exists along the northern border and stretches as far south as the man-made irrigation ditch. Within this area are 52 active prairie dog burrows. Based on favorable sighting conditions and thorough coverage during an on-site survey, it was determined that no black-footed ferrets were present (BRC, 1990a, 1990b). The remainder of the site is covered with cheatgrass and Russian thistle, indicating that its native vegetation has been disturbed.

Thermopolis, the nearest residential community, is approximately 7.5 miles southeast of the site. The Wind River Indian Reservation is 1 mile south.

3.5 Alternative 4: Galovich Site (CGS-15)

The Galovich site is undulating, with a 1 to 4 percent slope. Soils on the site are Shingle-Samday clay loam and Ustic Torriorth. Shingle-Samday clay loam is a highly erodible soil, neutral to strongly alkaline (pH 6.6 to 9.0), with slow to moderate permeability and a depth to the seasonally high water table of greater than 6 feet. It is not a hydric soil. Ustic Torriorth soils have widely varying pH and permeability characteristics that have not been calculated. The seasonally high water table is at or near the soil surface, and occasional flooding occurs, although the erosion hazard is minimal. These soils are considered hydric by the district SCS office (SCS, 1990).

A paleontological survey of the site revealed fossilized remains of invertebrates in the exposed Cody shale formations. These consisted of fragments of bivalves, which are fairly common in rocks of this age in Wyoming. In addition, the fossilized material is poorly preserved. No vertebrate fossilized remains were found, and none of the paleontological remains was considered significant (Breithaupt, 1990b).

The nearest sources of surface water are a man-made irrigation ditch that flows west to east through the CGS, and an intermittent stream, a tributary of Alkali Draw that flows across the site just south of the irrigation ditch. Another intermittent drainageway enters the site from the north and is interrupted by the raised berm area along the irrigation ditch. The main body of Owl Creek, the nearest perennial waterway, is approximately 1.1 miles south of the site, and the Big Horn River is approximately 9 miles east.

In an on-site survey, the COE determined that small wetland areas extend along the intermittent drainageway and along the intermittent stream that runs through the CGS (Bilodeau, 1990) (see Figure 3.1 of this EA). The site is currently used as pasture for horses and contains native vegetation including sagebrush, saltbush, and greasewood.

Thermopolis, the nearest residential community, is approximately 7.5 miles southeast of the site. The Wind River Indian Reservation is 1.1 miles south.

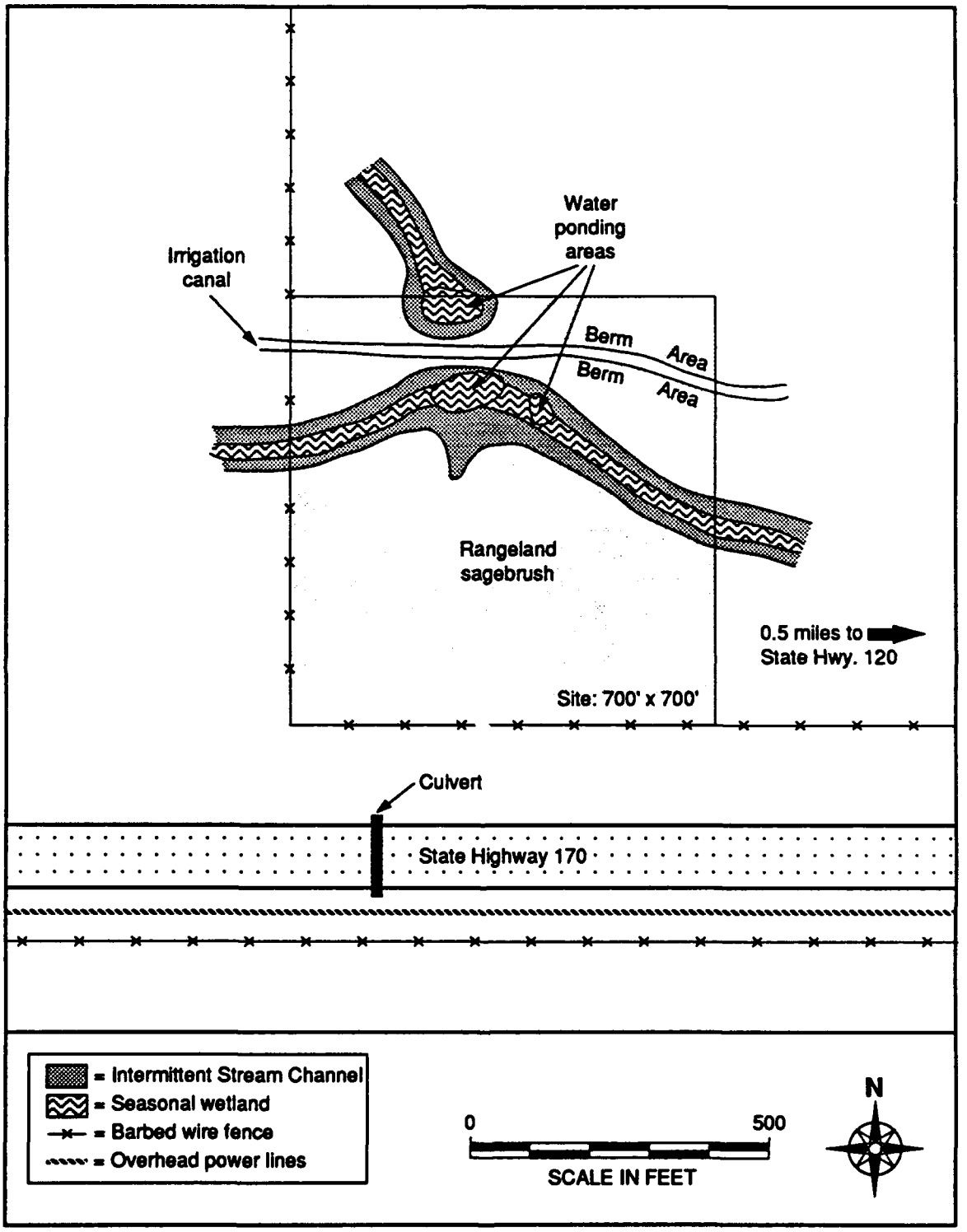

FIGURE 3.1 LOCATION OF SEASONAL WETLAND WITHIN 300 FEET OF THE GALOVICH SITE (CGS-15)

3.6 Alternative 5: Brown Site (CGS-20)

The Brown site is generally level, with a slope of 0 to 2 percent. Soils on the site are Copeman very fine sandy loam and Forkwood very fine sandy loam. Copeman very fine sandy loam is a highly erodible soil, alkaline to moderately alkaline (pH values 7.9 to 8.4), with moderate to moderately slow permeability and a depth to the seasonally high water table of greater than 6 feet. Forkwood very fine sandy loam is a neutral to strongly alkaline soil (pH 6.6 to 9.0), with moderate to moderately slow permeability and a depth to the seasonally high water table of greater than 6 feet; erosion hazard is minimal. Both soils are considered hydric by the district SCS office (SCS, 1990).

A wet weather drainage at the northern end of the site contains several soil anomalies—a saline spot, a sodic spot, and a heavy clay spot—and the fine sediments that have been deposited in the streambed over the years have lowered its permeability, causing a perched water table. Irrigation runoff from neighboring land drains into this streambed to support an artificial wetland (Chesky, 1991). (See Figure 3.2 of this EA.)

The nearest source of surface water is an intermittent tributary of Owl Creek that cuts across the northeastern corner of the site (the wet weather drainage mentioned above). A second tributary of Owl Creek flows approximately 600 feet south of the site, and the main body of the creek—the nearest perennial waterway—is approximately 2,800 feet southwest. The Big Horn River is approximately 11.5 miles east of the site.

In an on-site survey, the COE determined that the area along the intermittent stream in the northeastern corner of the site is a wetland (Bilodeau, 1990) (see Figure 3.2). The site has been cultivated in the past and is currently fallow (Arthur, 1991). Present use is for cattle grazing, and vegetative covering includes sagebrush, greasewood, saltbush, opuntia, and scattered grasses.

Thermopolis, the nearest residential community, is approximately 11 miles southeast. The Wind River Indian Reservation is 0.8 mile south.

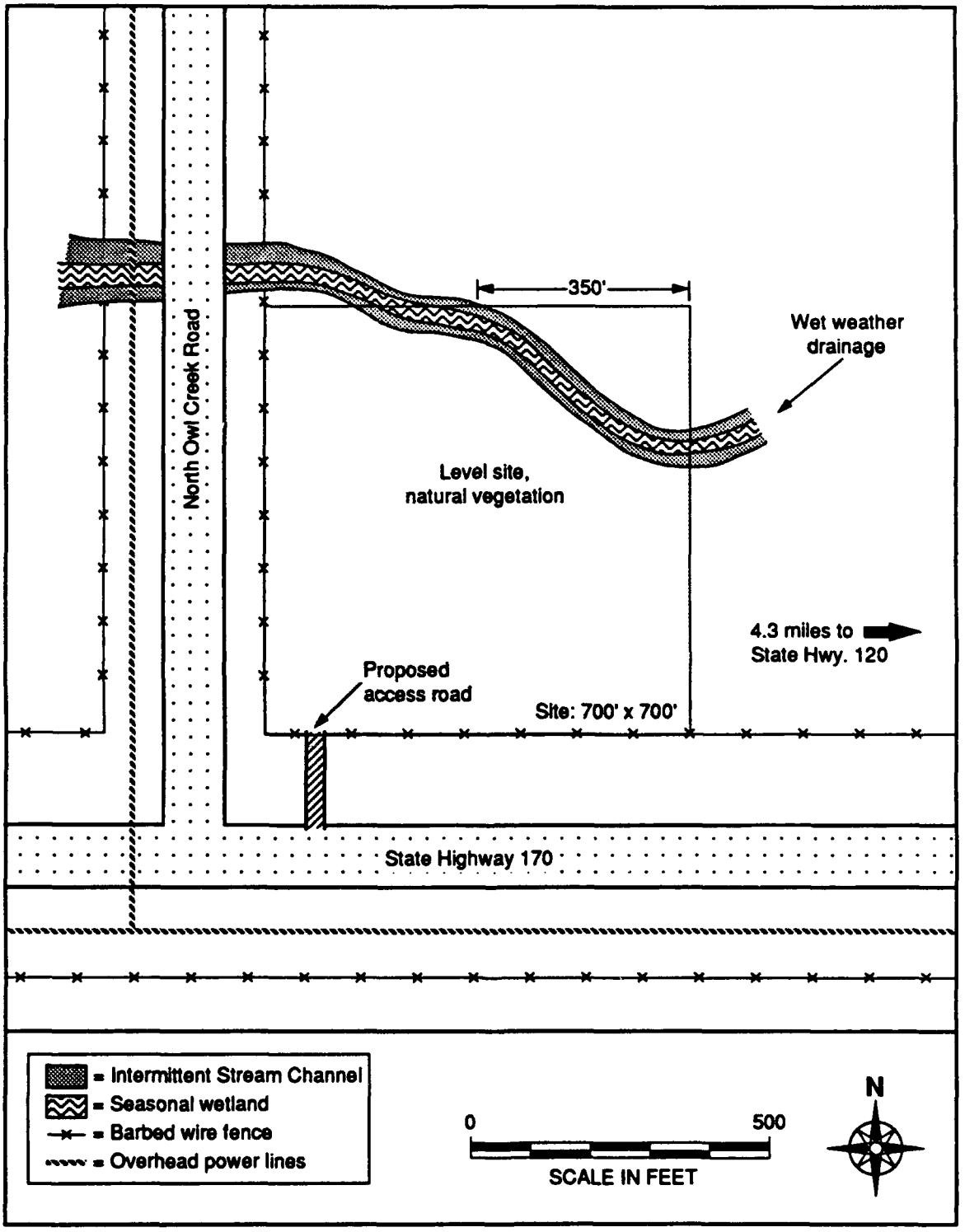

FIGURE 3.2 LOCATION OF SEASONAL WETLAND WITHIN 300 FEET OF THE BROWN SITE (CGS-20)

3.7 Alternative 6: Herrin Site (CGS-21)

The Herrin site is generally level, with a slope of 0 to 2 percent. Soil on the site is Copeman very fine sandy loam, a highly erodible soil that is moderately alkaline (pH 7.9 to 8.4), with moderate to moderately slow permeability and a depth to the seasonally high water table of greater than 6 feet. Copeman very fine sandy loam is considered a hydric soil by the district SCS office (SCS, 1990).

The nearest surface water is an intermittent tributary of Owl Creek that begins about 25 feet inside the eastern site boundary and flows southeast toward the creek. The main body of Owl Creek is approximately 2,600 feet south of the site. The Big Horn River is approximately 12.25 miles east.

In an on-site survey, the COE determined that there are no wetland areas on or within 300 feet of the site (Bilodeau, 1990). The site has been cultivated in the past and is currently fallow (Arthur, 1991). Present use is for cattle grazing, and vegetative covering includes sagebrush, greasewood, saltbush, opuntia, and scattered grasses. Eight active prairie dog burrows are on the site. Based on favorable sighting conditions and thorough coverage during an on-site survey, it was determined that no black-footed ferrets were present (BRC, 1990a, 1990b).

Thermopolis, the nearest residential community, is approximately 12 miles southeast. The Wind River Indian Reservation is 0.5 mile south.

4.0 ENVIRONMENTAL CONSEQUENCES OF ACTION ALTERNATIVES

This section discusses the potential impacts of the GWEN project on the environmental setting of the six CGSs in central Wyoming. Several impacts which would be common to some or all of the action alternatives are discussed in Section 4.1 of this EA. Impacts that are unique to each action alternative are discussed in Sections 4.2 through 4.7 of this EA. As indicated in Sections 4.4 and 4.5 of this EA, the project could have significant impacts to surface water or wetlands if the tower were built on the Shumway (CGS-14), Galovich (CGS-15), or Brown (CGS-20) site. There would be no significant impacts to the Bunch (CGS-9), Russell (CGS-10), or Herrin (CGS-21) sites.

4.1 Common Features

Presented below is information on the physical, biological, and socio-cultural impacts common to some or all of the action alternatives.

4.1.1 Physical

Impacts from **construction** activities would not be significant. Construction would require localized earth-moving, including excavation and backfilling for placement of foundations and guy-wire anchors. Less than 3,800 square feet would be covered with concrete and gravel for the tower base and the equipment area enclosures. Similar coverage would be required for on-site access roads and parking; incidental activities during construction would disturb a similar amount. In total, about 0.25 acre would be occupied by foundations and the on-site access roads. Construction of the off-site access road and installation of utility lines would have no significant impacts because the sites are on relatively level terrain and the access roads would require little grading. The amount of land disturbed for both the road and right-of-way would be 0.25 acre or less, depending on the site selected.

The ground plane would be installed using machines that bury wire approximately 1 foot below the surface with minimal disturbance of the soil surface. This process would require

moving a small tractor or similar equipment over much of the 11-acre site, but this would not significantly disturb the existing vegetation or create a significant erosion hazard.

Impacts to **mineral resources** would be minor, as indicated in Section 4.1.1.4, page 4.1-2 of the FEIS. In most cases, mineral resources were avoided in the siting process. The CGSs in central Wyoming are at least 4.5 miles from the nearest oil field, the only significant resource in the area (Marrel, 1990). If resources are present under the CGSs, access to them is unlikely to be restricted, due to the small size of the GWEN site. If access is restricted, development of the site would only deny access to a small portion of those resources for the lifetime of the project and would not result in any significant impacts.

Significant impacts on **paleontological resources** are not expected. The on-site paleontological survey determined that only the Galovich site (CGS-15) contains fossil remains, and these are not of sufficient quality or uniqueness to be significant (Breithaupt, 1990b). If any fossils are found during construction, work that might affect them will be suspended while the Wyoming Geological Survey is notified and the significance of the find is evaluated.

Erosion and increase in storm water runoff would not be significant. All sites have slopes of 4 percent or less, so any required grading to level the site would be minimal. In addition, standard measures for erosion control would be used during and after site construction, including replanting the site.

None of the sites is located in a **100-year floodplain** (FIA, 1986).

No **prime farmland** would be removed from production for the duration of the project, as none of the soils on the CGSs is designated prime farmland (SCS, 1990).

No significant impacts on **drinking water** are expected, as discussed in Section 4.2.1.1, page 4.2-3 of the FEIS. Corrosion of the ground plane is not anticipated to raise copper concentrations in any aquifer or surface water body by more than 20 micrograms per liter (µg/l). The standard for copper in drinking water in the State of Wyoming is 1.0 milligrams per liter (mg/l) (Forester, 1990). Therefore, the maximum copper concentration expected

represents 2 percent of the maximum allowable copper concentrations permitted by the State of Wyoming for raw water sources for potable water supply.

Impacts on **surface water and wetlands** that support aquatic plants and animals could be significant on three sites (Shumway, CGS-14; Galovich, CGS-15; and Brown, CGS-20) because of soil conditions and the presence of water or wetlands on or within 300 feet of these sites. These impacts are discussed in Sections 4.4, 4.5 and 4.6 of this EA. No significant impacts would occur at the other three sites, as discussed in Sections 4.2, 4.3 and 4.7 of this EA. Impacts would only occur if the site were within 300 feet of surface water and if the soils were acidic or the seasonally high water table were within 3 feet of the ground plane (4 feet from the surface), as discussed in Section 4.2.1.1, page 4.2-3 of the FEIS. Without this combination of conditions, the potential for transport of copper away from the immediate area of the ground plane and into surface water or wetlands would be negligible.

Impacts on **air quality** would not be significant. Temporary but insignificant increases in air pollutant emissions would occur during construction, primarily from greater use of heavy machinery than would be required in normal farming operations. During operation of the BUPG at 100 percent load, total yearly emissions from the BUPG would be less than 350 pounds per pollutant, as described in Section 2.1.2 of this EA. These are well below the standards set by the Clean Air Act (42 USC 7401, *et seq.*), which requires permits for facilities emitting any single regulated substance at the rate of 50 tons per year. Hence, the project would not result in violation of National Primary and Secondary Ambient Air Quality Standards, which have been adopted by the State of Wyoming (Wyoming Statutes 35-11-202).

4.1.2 Biological

Impacts on **wetlands and other wildlife habitats** could be significant on the Galovich (CGS-15) and Brown (CGS-20) sites, because the ground plane could intrude into the wetland areas, and copper leachate in the intermittent streams could affect the wetland habitats on the sites. Neither site provides significant wildlife habitat because both have been disturbed by grazing and tilling, they have minimal vegetation to allow for avian

nesting, and no large water bodies or waterfowl were observed during field investigations (Bergen, 1990; Campbell, 1990b). If selected as the preferred GWEN site, either site would require a 404 permit from the COE, pursuant to Section 404 of the Clean Water Act (33 USC 1344) (Gooley, 1991a). A potential wetland occurs along an intermittent stream 200 feet east of the Shumway site (CGS-14). Impacts on wetlands are unknown at this site because livestock had eaten the vegetation to the extent that a determination of hydrophytic vegetation could not be made at the time of the field investigation (Bilodeau, 1990). These wetlands issues are discussed in Sections 4.4, 4.5, and 4.6 of this EA. No significant impacts on wetlands and wildlife habitats are expected at the other three sites because the distances from extensive areas of woodland, ponds, lakes, or perennial streams are more than a mile, and all of these sites are more than 300 feet from wetlands. All of the CGSs are currently used for pasture, although some sites have been previously cultivated.

Bird collisions with the tower may occur but are not expected to be significant. Section 4.4.1.5, page 4.4-5 of the FEIS states that the majority of bird collisions occur in adverse weather conditions when the visibility of man-made structures is obscured and birds are forced to lower their flight level. Generally, songbirds (passerines) are more likely to collide with a tower or the guy wires than are raptors or waterfowl (Avery *et al.*, 1980). The siting process aims to minimize the probability of collisions by avoiding areas with high concentrations of bird flight activity, such as feeding and nesting habitats, known migration corridors, and raptor roosting areas. No prominent topographical features that could serve as navigational aids exist near the CGSs, and each of the sites is at least 1.5 miles from the Big Horn River and its avian flyway.

No federally listed **threatened or endangered species** is likely to be adversely affected. This determination was made after informal consultation with the USFWS in compliance with Section 7 of the Endangered Species Act of 1973 as amended (16 USC 1531, *et seq.* at 1536) (Appendix C, Starkey, 1991, page C-6 of this EA). An on-site biological survey in October 1990 established that no habitat for two of the endangered species, the bald eagle and the peregrine falcon, is found on or within 1.5 miles of any of the CGSs. The same survey established that although limited habitat for the black-footed

ferret exists on two sites (Shumway, CGS-14; Herrin, CGS-21), no black-footed ferrets were present (BRC, 1990a, 1990b).

No significant impacts are expected on the ferruginous hawk. The forest breeding habitat for the hawk is absent from the CGSs, all of which lack trees and are covered with native vegetation of sagebrush, greasewood, saltbush, opuntia, and scattered grasses. It is possible that non-breeding individuals may forage in the area on a seasonal basis, and they could collide with a GWEN tower or its associated wires. But given the brevity of the typical foraging flight and the use of perches, the probability is low that a foraging ferruginous hawk would be involved in prolonged pursuit of prey that might prevent detection of the tower and its wires in time to take evasive action. Thus, the tower is not expected to significantly impact either nesting or foraging activties.

No significant impacts are expected on the loggerhead shrike. Shrikes nest near water and the CGSs contain no perennial streams or ponds. The banks of the Big Horn River, which might provide potential nesting sites, are 1.5 miles from the nearest CGSs. The shrike could forage near the CGSs, which are covered with native vegetation and used as pasture and rangeland. However, given the foraging behavior of the shrike, which consists of short, straight flights from nearby perches, the probability of a shrike colliding with a guy wire is low, so the tower would not pose a significant hazard to the foraging shrike.

No significant impacts are expected on the mountain plover or its habitat. The native vegetation will be retained on the GWEN site, so the habitat quality with respect to this species would remain substantially unchanged. The risk of collision of these birds with the guy wires would be low given their ground-based foraging patterns.

No significant impacts are expected on the white-faced ibis. It requires a wetland habitat for breeding, and none of the CGSs contains perennial streams or permanent wetlands. Small intermittent streams, with associated wetlands, occur on or within 300 feet of three CGSs (CGSs-14, -15, and -20), but these are not considered prime habitat for the ibis. Although the ibis might occasionally forage near the seasonal wetlands, the risk of

collision of these birds with the guy wires would be low given their ground-based foraging patterns.

No significant impacts are expected on the long-billed curlew. The CGSs contain no prairies, grassy meadows, ponds, beaches or mudflats, the primary breeding and foraging habitats for the curlew. The CGSs are covered with native shrubs such as sagebrush, greasewood, and saltbush. Small intermittent streams, with associated wetlands, occur on or within 300 feet of three CGSs (CGSs-14, -15, and -20), but this is not considered prime habitat for the long-billed curlew. Although the curlew might occasionally forage near the seasonal wetlands, the risk of collision of these birds with the guy wires would be low given their ground-based foraging patterns.

No significant impacts are expected on the black tern. Prime breeding and foraging habitat for this species are wet meadows and marshes, habitats absent from the CGSs. Although the tern might forage occasionally near the small seasonal wetlands on or near three of the CGSs (CGSs-14, -15, and -20), impacts would not be significant.

No signifcant impacts are expected on the Sturgeon chub. Its habitat is large rivers, and the Big Horn River is at least 1.5 miles from the nearest CGS.

The State of Wyoming does not have an official list of threatened and endangered species but does maintain a list of nongame species in need of special management. The Wyoming Department of Game and Fish had no serious concerns regarding the project (Ritter, 1990).

4.1.3 Socio-Cultural

Local employment would be increased slightly, primarily through use of local subcontractors for earth-moving and possibly for some of the facility's maintenance.

Impacts on **community support systems** would not be significant because the relay node will be unmanned and will use modest amounts of power (comparable to that used by an average single-family house). Security needs will be met through agreements with

local police officials to monitor the integrity of the site during routine patrols, as detailed in Section 4.6.1.1, page 4.6-1 of the FEIS.

Impacts on **land use** would not be significant. All candidate sites are zoned agricultural (Williams, 1990). Care was taken in the site selection process to maintain setbacks from institutional uses such as schools, churches, recreational areas, and areas zoned residential. The tower would not significantly affect property values because non-noxious, nonresidential land uses, such as the proposed relay node, have no systematic effect on housing values, as stated in Section 4.7.1.3, page 4.7-8 of the FEIS.

Construction **noise** impacts would be temporary and insignificant. Operational noise from the backup generator would be less than 72 dBA at the site boundary. At 50 feet beyond the site boundary the noise level would drop below 65 dBA, as discussed in Section 2.1.2 of this EA. Although Hot Springs County has no local noise ordinance (Williams, 1990), this noise level is within the standards typically set for residential and mixed residential/agricultural use (55 to 65 dBA), as stated in Section 3.5.3, page 3.5-2 of the FEIS. In addition, the BUPG would only operate at this noise level for 2 hours per week during testing and during commercial power outages.

Impacts on **public health and safety** would not be significant, as discussed in Sections 4.11 and 4.12, beginning on pages 4.11-1 and 4.12-1, respectively, of the FEIS. Shock and burn risks would be associated with the buildup of electrical charges on ungrounded metallic objects inside the inner exclusionary (8-foot) fence located approximately 20 feet from the tower base. However, a grounded person within the outer exclusionary (4-foot) fence located approximately 330 feet from the tower base who touches an ungrounded object while the tower was transmitting would experience only a mild shock, sufficient to cause the individual to break contact but not cause harm. Furthermore, because the transmission periods would total between 6 and 8 seconds per hour during normal operations, the risk of even these mild shocks would be insignificant. Only a determined effort to enter the inner exclusionary zones, within the 8-foot fence, would put a person at increased risk of higher shock and a higher specific absorption rate, dependent on the period of prolonged grasping contact with an ungrounded metallic object. Fire hazards at the relay node facility would be low, as described in Section 4.12.1.1, page 4.12-1 of the

FEIS. Radio-frequency emissions would not cause adverse health effects, as discussed in Section 4.4.1.6, pages 4.4-6 and 4.4-7 of the FEIS. Subsequent to the publication of the FEIS, further study confirmed the conclusion of the FEIS that there is no evidence of adverse effects of GWEN radio-frequency emissions on public health (NRC, 1992).

The relay node would operate in the LF band and therefore would not interfere with pacemakers, emergency communications, commercial and amateur radios, televisions, or garage door openers, as noted in Section 2.1.1.1, page 2-3 of the FEIS.

Impacts on **archaeological resources** would not be significant. The on-site archaeological survey identified no archaeological resources on any of the six CGSs (Arthur, 1991). The Wyoming SHPO has concurred with this determination (Appendix C, Marceau, 1990, page C-8 of this EA). If any archaeological resources are found during construction, work that might affect them will be suspended while the Wyoming SHPO is notified in accordance with the provisions of 16 USC 470, *et seq.*, at 470f.

Impacts on **historic properties** would not be significant. Portions of the Bridger Trail (eligible for listing on the NRHP) possibly pass within 1.5 miles of the Bunch (CGS-9) and Russell (CGS-10) sites. However, no evidence of the original Bridger route was observed and the graded roads that overlie the potential route have compromised any integrity that may have been present. Therefore these potential sections of the trail were determined not to contribute to its overall significance. No other property within 1.5 miles of any CGS is listed, eligible, or potentially eligible for listing on the NRHP (Arthur, 1991). The Wyoming SHPO has concurred with this determination (Appendix C, Marceau, 1990, page C-8 of this EA).

Significant impacts to **Native American traditional, religious, or sacred sites** are not anticipated according to responses received from representatives of the Arapaho tribe (Antelope, 1991) and the Historic Preservation Officer of the Wind River Agency (Nation, 1990). No response has been received from the Shoshoni tribe's tribal attorney.

Visual impacts associated with a GWEN tower are discussed in Sections 3.8 and 4.8, pages 3.8-1 and 4.8-1, respectively, of the FEIS. The significance of a visual impact would

depend on the visual dominance of the GWEN facility and the sensitivity of the affected views. Visual dominance is the degree to which a GWEN facility would compete with other features of the existing landscape for the attention of the viewer. Section 3.8.4, beginning on page 3.8-3 of the FEIS defines four levels of dominance, called Visual Modification Classes (VMC):

- VMC 1, not noticeable: the tower would be overlooked by all but the most interested viewers
- VMC 2, noticeable, visually subordinate: the tower would be noticeable to most viewers without being pointed out but would not compete with other features for their attention
- VMC 3, distracting, visually codominant: the tower would compete with other features in the landscape for the viewer's attention
- VMC 4, visually dominant, demands attention: the tower would be the focus of attention and tend to dominate the view.

Visual sensitivity is a measure of the public's reaction to a proposed change of the affected view and is a function of the viewer's activity, awareness, goals, and values. Consequently, the more sensitive the view, the stronger will be the public reaction to any alteration of it. Areas defined in the FEIS as having high visual sensitivity include national and state parks; designated scenic routes; designated national, state, or local historic sites where setting is important to their historic significance; and travel routes providing primary access to these sites. Examples of areas having medium visual sensitivity would be locally popular, but undesignated, beaches or public use areas and travel routes that provide primary access to them. Low visual sensitivity includes those views from sites, areas, travel routes, and sections of travel routes not identified as medium and high in sensitivity.

Significant visual impacts would occur if the relay node facility were to dominate or codominate (VMC 4 or 3) a high-sensitivity view or dominate (VMC 4) a medium-sensitivity view. If the relay node facility cannot be seen from medium-to-high sensitivity routes or areas, then visual impacts are not considered significant. Distance is the primary factor in determining visual dominance and therefore visual impacts. At distances greater than 3 miles, a GWEN tower would not be visible to the unaided eye. At 1.5 to 3 miles, the tower would be visually subordinate if noticeable (VMC 2) but more usually would not be noticed (VMC 1) because of its grey color and lack of mass. If a viewer at this distance actively sought the tower, it would appear as a thin vertical line on the horizon. Within 1.5 miles, the tower becomes a more important component of the view. In addition, other aspects of the tower's setting, such as focal point sensitivity, skyline complexity, competing feature interest, and topographic and vegetative screening, become important considerations in determining the level of visual impact.

USGS topographic maps and a windshield survey were used to determine whether high or medium sensitivity views were within 1.5 miles of the CGSs. **Visual** impacts would not be significant because there are no high or medium sensitivity views within 1.5 miles of any of the CGSs.

4.2 Alternative 1: Bunch Site (CGS-9)

No significant impacts are expected.

Impacts on **surface water or wetlands** would not be significant because no surface water or wetland areas exist on or within 300 feet of the site (Bilodeau, 1990).

No significant impacts on **wildlife and wildlife habitats** are expected. The site is 1.5 miles from the avian flyway along the Big Horn River, sufficiently removed from the river corridor to avoid adversely affecting migratory waterfowl or raptor habitat (Campbell, 1990a).

4.3 Alternative 2: Russell Site (CGS-10)

No significant impacts are expected.

Impacts on **surface water or wetlands** would not be significant. The site has surface water within 300 feet, but the soils are neutral to strongly alkaline and the depth to the seasonally high water table is greater than 6 feet; therefore, no impacts to surface water are expected. In an on-site survey, the COE determined that no wetlands exist on or within 300 feet of the site (Bilodeau, 1990).

Impacts on **wildlife and wildlife habitats** would not be significant. The site is 5 miles from the avian flyway along the Big Horn River, sufficiently removed from the river corridor to avoid adversely affecting migratory waterfowl or raptor habitat (Campbell, 1990a).

4.4 Alternative 3: Shumway Site (CGS-14)

Significant impacts are expected.

Impacts on **surface water or wetlands** could be significant. An intermittent stream occurs within 200 feet of the eastern site boundary, and the depth to the seasonally high water table is less than 3 feet from the ground plane for two of the three soils on the site. Therefore, sufficient copper could leach into the stream to exceed state standards for copper, thereby causing a significant impact. In an on-site survey, the COE determined that a potential wetland area occurs along the intermittent stream, but livestock had eaten the vegetation to the extent that a determination of hydrophytic vegetation could not be made until the next growing season (Bilodeau, 1990). Therefore, impacts on wetlands are not known.

Impacts on **endangered species or wildlife habitats** would not be significant. Although the site contains 52 active prairie dog burrows, an on-site biological survey determined that this prairie dog population does not support any black-footed ferrets. No black-footed ferrets are known to occur anywhere in the wild and the small area required for the tower would not eliminate prairie dogs from the site (BRC, 1990a, 1990b; Crete,

1991). The potential wetland area on the site does not provide significant wildlife habitat (Campbell, 1990b).

4.5 Alternative 4: Galovich Site (CGS-15)

Significant impacts are expected.

Impacts on **surface water or wetlands** could be significant. An intermittent stream crosses the CGS, and the depth to the seasonally high water table is less than 3 feet from the ground plane for one of the two soils on the site. Therefore, sufficient copper could leach into the stream to exceed state standards for copper, thereby causing a significant impact. In addition, in an on-site survey, the COE determined that wetland areas occur along the stream, both on and near the site (Bilodeau, 1990). These wetlands were identified as being less than 1 acre in size, with typical hydrophytic vegetation (sedges and rushes) growing within the intermittent streambed. The wetlands are caused by seepage from the irrigation ditch that runs just north of the intermittent stream (Gooley, 1991b). The copper leaching into the stream could affect this wetland habitat, thereby causing a significant impact. If selected as the preferred GWEN site, this site would require a 404 permit from the COE, pursuant to Section 404 of the Clean Water Act (33 USC 1344) (Appendix C, Bilodeau, 1991, pages C-12 through C-14 of this EA).

Impacts on **paleontological resources** are not expected. Although fossilized remains of invertebrates were found in the Cody shale on the site, this material is poorly preserved and fairly common throughout Wyoming and is therefore not considered significant (Breithaupt, 1990b).

4.6 Alternative 5: Brown Site (CGS-20)

Significant impacts are expected.

Impacts on **surface water or wetlands** could be significant. An intermittent stream, or wet weather drainage, crosses the site. The soils on the site are alkaline and the depth to the seasonally high water table is greater than 6 feet, and under these conditions

significant impacts would not normally occur. However, the settling of fine sediments in the stream channel has caused a perched water table, and water remains longer in the streambed than it would in other parts of the CGS with the same soil types. In addition, in an on-site survey the COE determined that small wetland areas occur along the intermittent stream, both on and near the site (Bilodeau, 1990). These wetland areas were identified as less than 1 acre in size, with typical hydrophytic vegetation (willows, sedges, and rushes) growing within the intermittent streambed. The source of water for the wetland areas comes from irrigation runoff from neighboring lands (Chesky, 1991). The copper leaching into the stream could affect this wetland by exceeding state standards for copper, thereby causing a significant impact. If selected as the preferred GWEN site, this site would require a 404 permit from the COE, pursuant to Section 404 of the Clean Water Act (33 USC 1344) (Gooley, 1991a; Appendix C, Bilodeau, 1991, pages C-12 through C-14 of this EA).

4.7 Alternative 6: Herrin Site (CGS-21)

No significant impacts are expected.

Impacts on **surface water or wetlands** would not be significant. Although an intermittent stream begins about 25 feet inside the site's eastern boundary, the soil is alkaline and the depth to the seasonally high water table is greater than 6 feet. Under these conditions, no impacts to surface water from copper leachate are expected. In addition, the portion of the stream channel inside the site would not be physically disturbed because the closest approach of the ground plane is approximately 100 feet from the channel. In an on-site survey, the COE determined that no wetlands exist on or within 300 feet of the site (Bilodeau, 1990).

Impacts on **endangered species or wildlife habitats** would not be significant. Although the site contains eight active prairie dog burrows, an on-site biological survey determined that this prairie dog population does not support any black-footed ferrets. No black-footed ferrets are known to occur anywhere in the wild, and the small area required for the tower would not eliminate prairie dogs from the site (BRC, 1990a, 1990b; Crete, 1991).

4.8 No Action Alternative

No environmental impact would result from adoption of the no action alternative.

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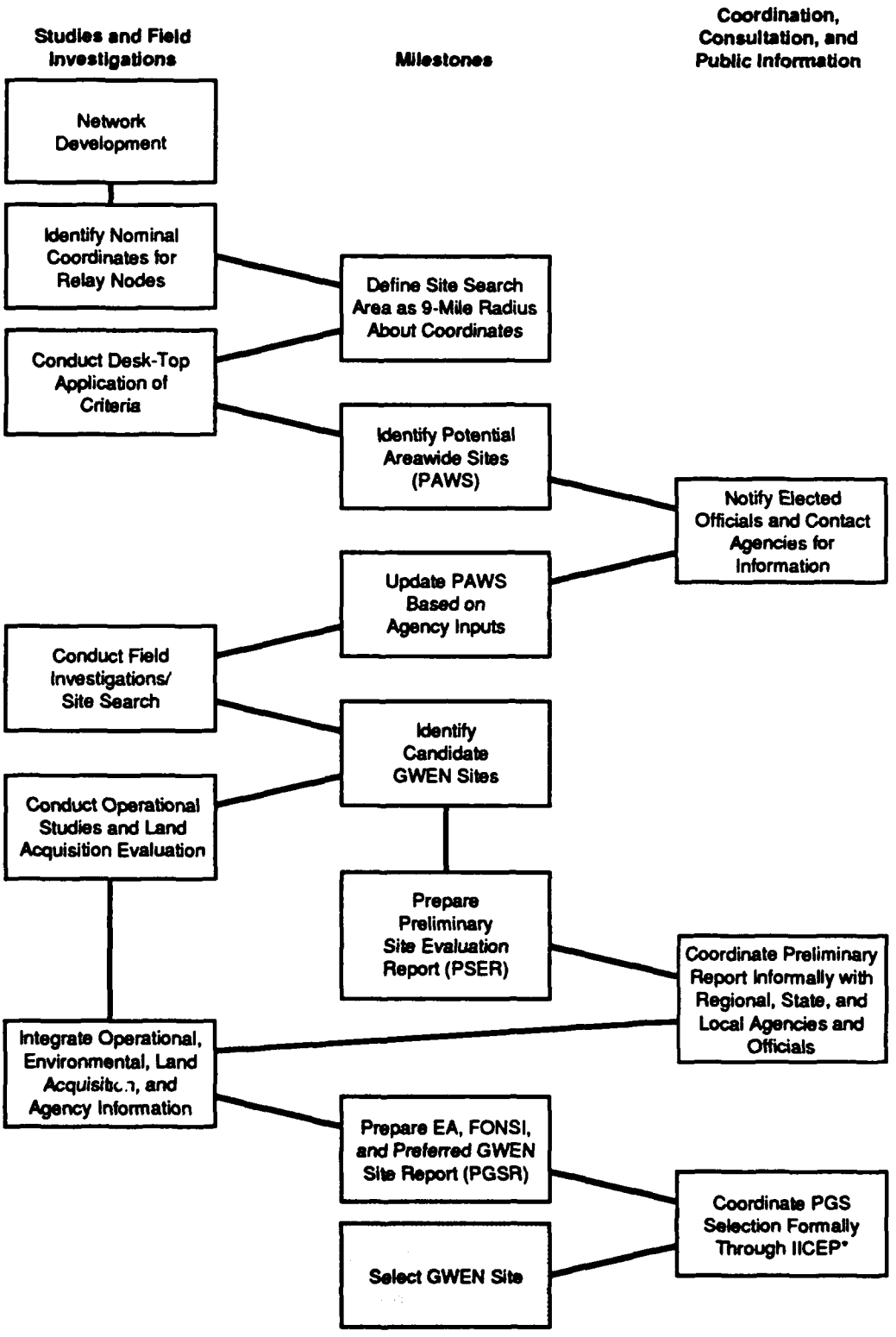
APPENDIX A

SITE SELECTION PROCESS

SITE SELECTION PROCESS

Figure A.1 of this EA shows the sequence of events during the selection of individual GWEN sites. Figure A.2 of this EA describes the screening process used during the field investigation to choose the candidate GWEN sites (CGSs). The environmental siting criteria applied in the site selection process are defined in Tables 5-1 and 5-2, pages 5-7 through 5-14 of the FEIS.



*IICEP = Interagency/Intergovernmental Coordination for Environmental Planning.

FIGURE A.1 GROUND WAVE EMERGENCY NETWORK SITE SELECTION PROCESS

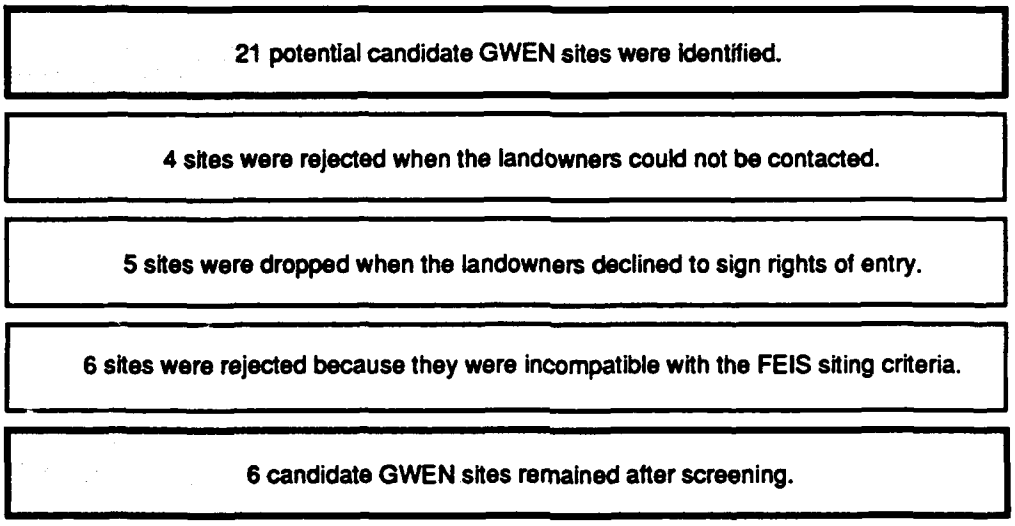


FIGURE A.2 RESULTS OF USING FEIS SITING CRITERIA TO SCREEN POTENTIAL CANDIDATE GWEN SITES IN THE CENTRAL WYOMING SITE SEARCH AREA

APPENDIX B

TOPOGRAPHIC SETTINGS OF CANDIDATE GWEN SITES

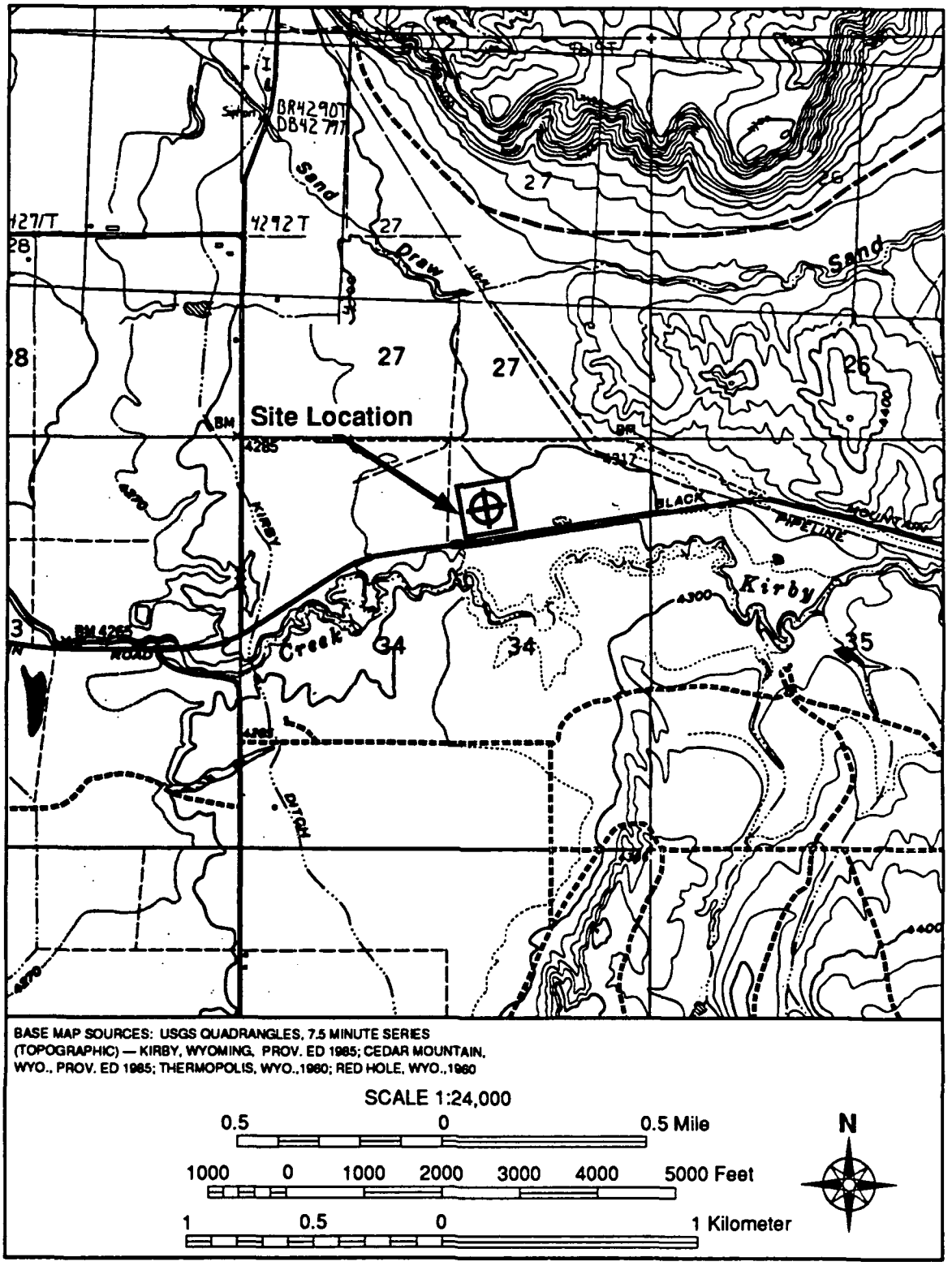


FIGURE B.1 TOPOGRAPHIC SETTING OF THE BUNCH SITE (CGS-9)

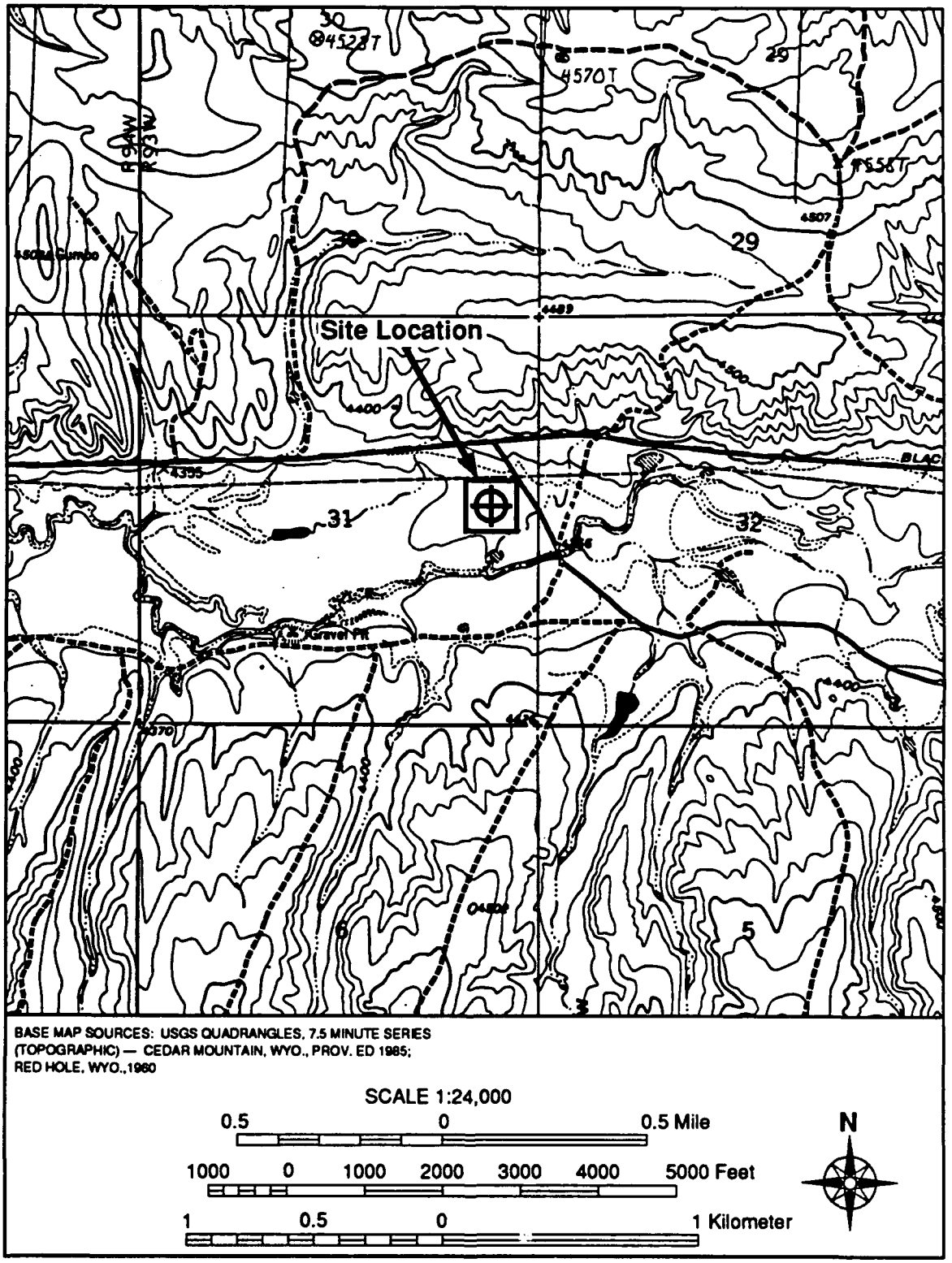


FIGURE B.2 TOPOGRAPHIC SETTING OF THE RUSSELL SITE (CGS-10)

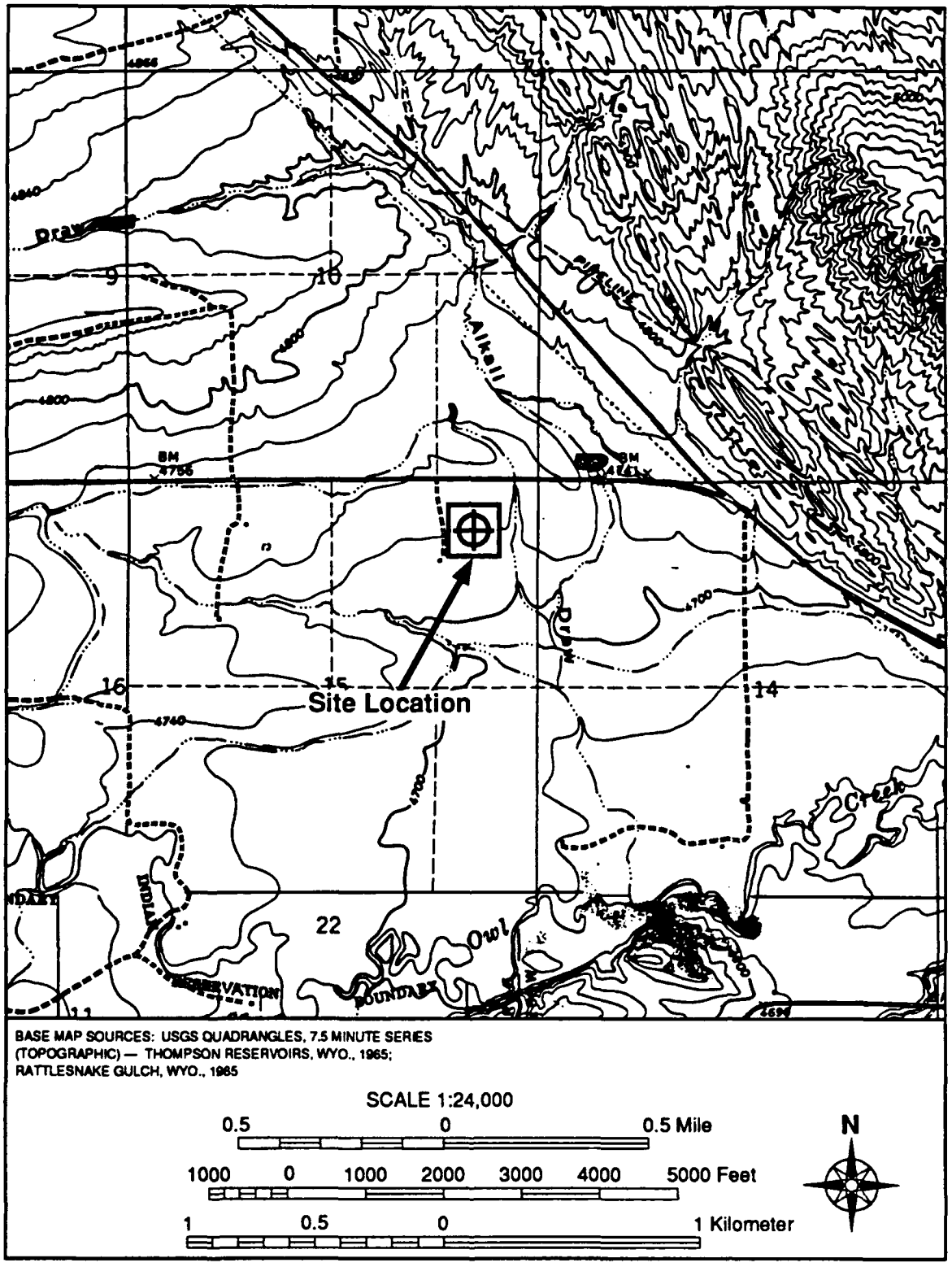


FIGURE B.3 TOPOGRAPHIC SETTING OF THE SHUMWAY SITE (CGS-14)

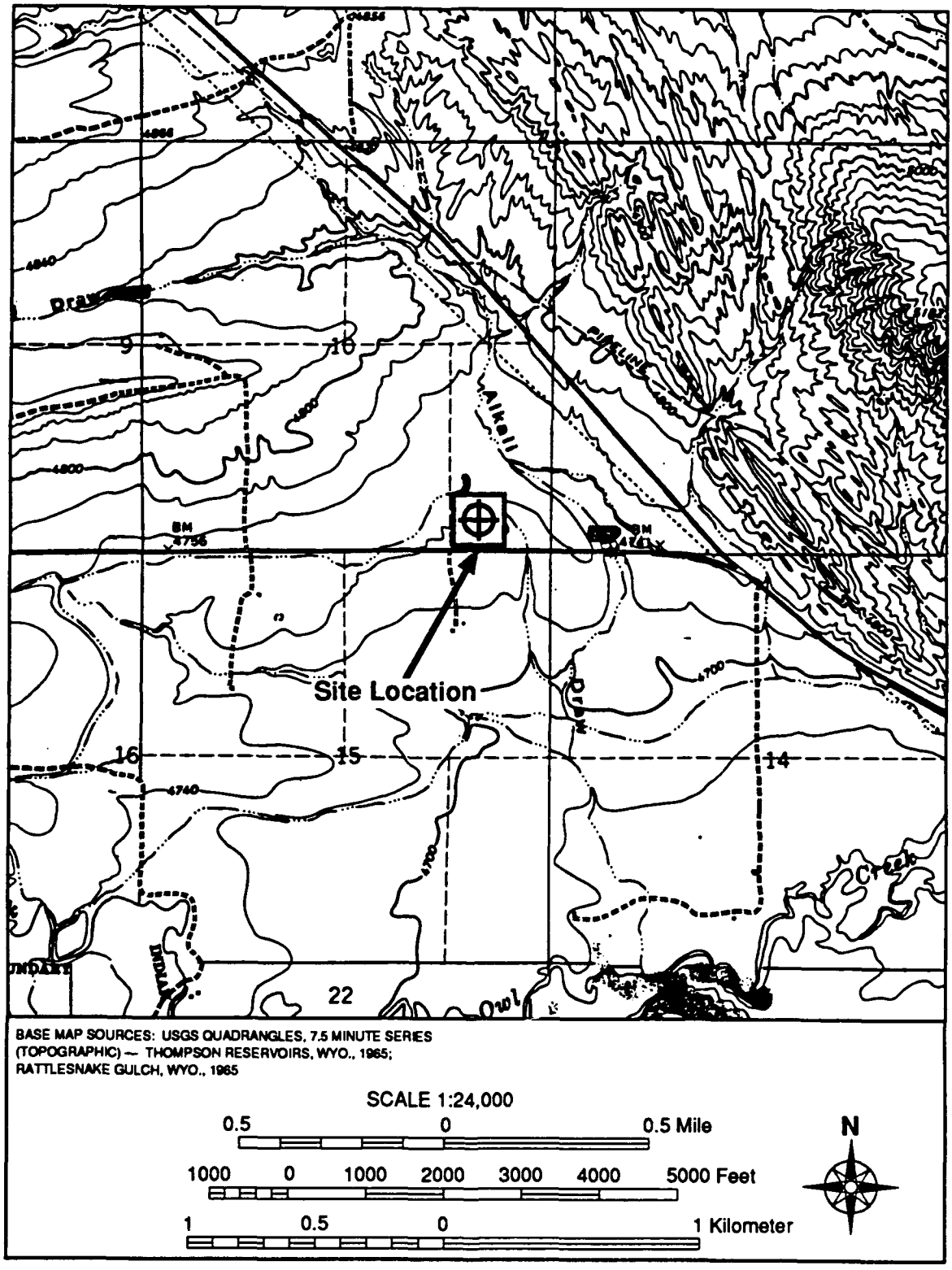


FIGURE B.4 TOPOGRAPHIC SETTING OF THE GALOVICH SITE (CGS-15)

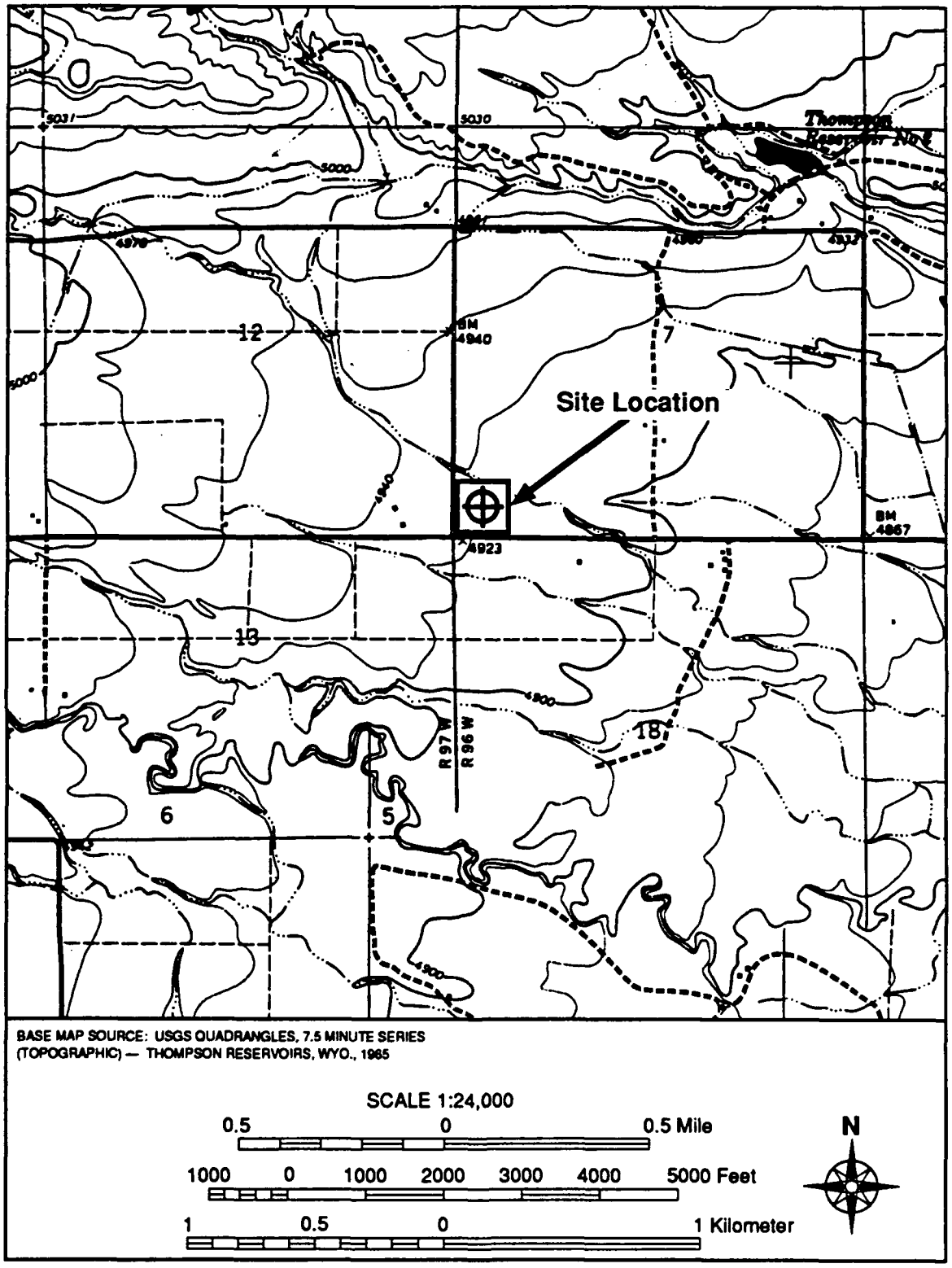


FIGURE B.5 TOPOGRAPHIC SETTING OF THE BROWN SITE (CGS-20)

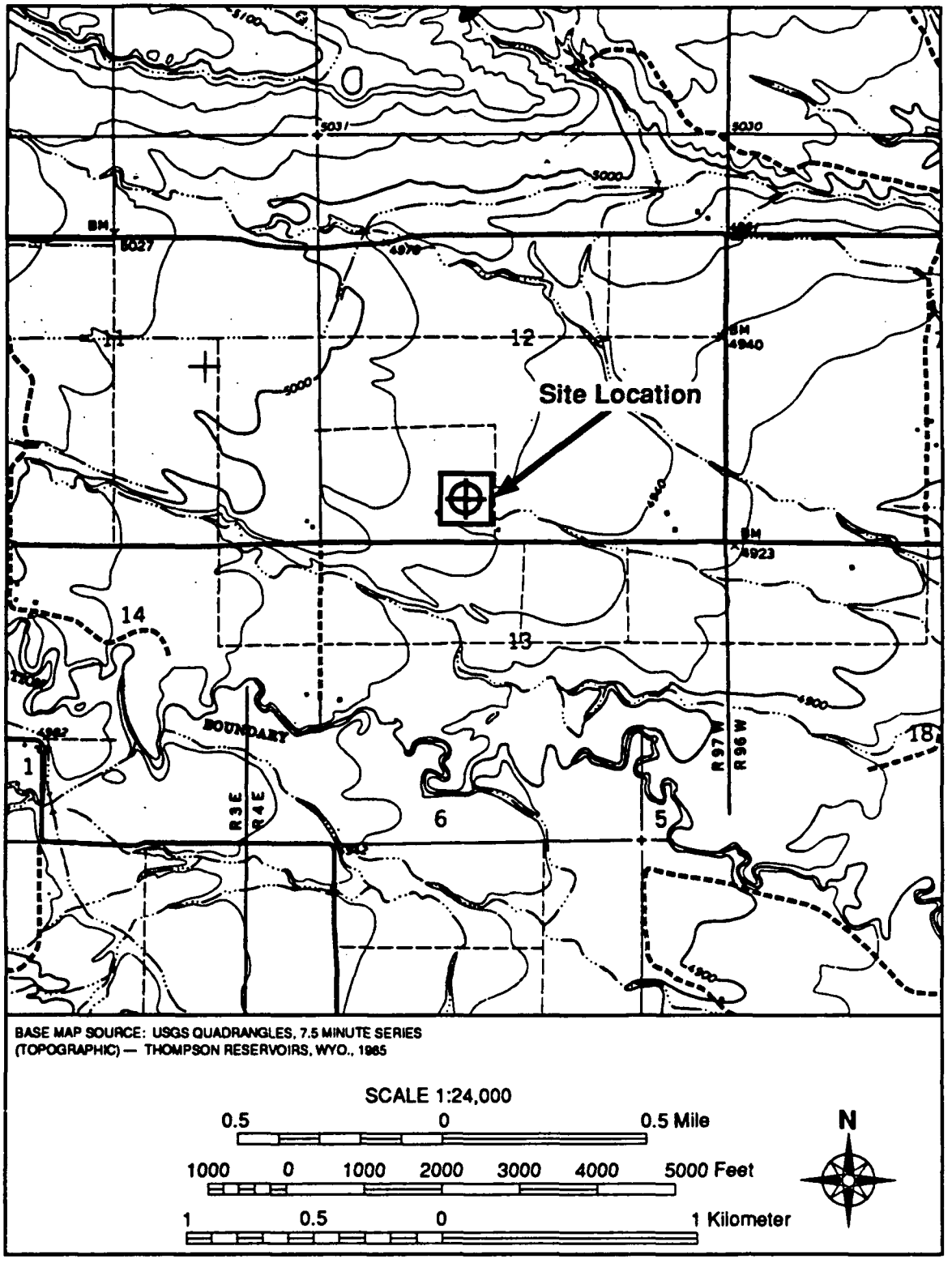


FIGURE B.6 TOPOGRAPHIC SETTING OF THE HERRIN SITE (CGS-21)

APPENDIX C

CORRESPONDENCE

CORRESPONDENCE

Appendix C documents contacts with the following federal and state agencies and Native American groups:

Individual	Agency	Date	Response
Ronald G. Starkey, State Supervisor, Wyoming State Office	U.S. Department of the Interior, Fish and Wildlife Service	08-14-90 02-05-91	Attached Attached
Thomas E. Marceau, Deputy SHPO	Wyoming State Archives, Museums and Historical Department	05-21-90 12-27-90	Attached Attached
Richard L. Bryant, Review and Compliance Program Manager	Wyoming Department of Commerce	08-31-90	Attached
Matthew A. Bilodeau, Regulatory Branch Operations Division	Department of the Army Corps of Engineers, Omaha District	11-16-90 02-04-91	Attached Attached
Charles P. Davis, State Supervisor, Wyoming State Office	U.S. Department of the Interior, Fish and Wildlife Service	04-28-92 01-06-93	Attached Attached
David L. Allison, Superintendent	Wind River Agency, Wind River Indian Reservation	Letter sent on 08-24-90. No written response received to date. Phone communication with R. Nation on 11-15-90.	
Burton Hutchinson, Sr., Chairman	Arapaho Business Council	Letter sent on 05-14-91. No written response received to date. Phone communication with D. Antelope on 06-11-91.	

Individual	Agency	Date Response
Alfred Ward, Chairman	Shoshoni Business Council	Letter sent on 05-14-91, but no response has been received to the letter or to several attempts at phone communication.

United States Department of the Interior
FISH AND WILDLIFE SERVICE
Fish and Wildlife Enhancement
2617 East Lincolnway, Suite A
Cheyenne, Wyoming 82001

TAKE PRIDE IN AMERICA

IN REPLY REFER TO
W.37 USAF GWEN

August 14, 1990

Elizabeth Bergen
Earth Metrics Inc.
2855 Campus Drive, Suite 300
San Mateo, California 94403

Dear Ms. Bergen:

This responds to your letter dated August 9, 1990 regarding the proposed Ground Wave Emergency Network (GWEN) facility in Hot Springs county, Wyoming. In compliance with Section 7(c) of the Endangered Species Act of 1973, as amended (ESA), we have determined that the following listed and proposed threatened or endangered (T/E) species may be present in the project area.

Listed Species	Expected Occurrence
Black-footed ferret (Mustela nigripes)	Potential resident in prairie dog (Cynomys sp.) colonies.
Bald eagle (Haliaeetus leucocephalus)	Winter resident. Migrant.
Peregrine falcon (Falco peregrinus)	Migrant.

*Proposed species

None.

Section 7(c) of ESA requires that Federal agencies proposing major construction actions, complete a biological assessment to determine the effects of the proposed actions on listed and proposed species. If a biological assessment is not required (i.e., all other actions), your agency is responsible for review of proposed activities to determine whether listed species will be affected. We would appreciate the opportunity to review your determination document.

For those actions where a biological assessment is necessary, it should be completed within 180 days of initiation, but can be extended by mutual agreement between your agency and the Fish and Wildlife Service (Service). If the assessment is not initiated within 90 days, the list of T/E species should be verified with the Service prior to initiation of the assessment. The biological assessment may be undertaken as part of your agency's compliance of Section 102 of the National Environmental Policy Act (NEPA), and incorporated into the NEPA documents. We recommend that biological assessments include:

1. a description of the project;
2. the current status, habitat use, and behavior of T/E species in the project area;
3. discussion of the methods used to determine the information in item 2;
4. direct and indirect impacts of the project to T/E species;
5. cumulative impacts from federal, state, or private projects in the area;
6. coordination measures that will reduce/eliminate adverse impacts to T/E species;
7. the expected status of T/E species in the future (short and long term) during and after project completion;
8. determination of "is likely to adversely affect"/"is not likely to adversely affect" for listed species;
9. citation of literature and personal contacts used in assessment.

If it is determined that any agency program or project "is likely to adversely affect" any listed species, formal consultation should be initiated with us. If it is concluded that the project "is not likely to adversely affect" listed species, we should be asked to review the assessment and concur with the determination of no adverse effect.

A Federal agency may designate a non-Federal representative to conduct informal consultation or prepare biological assessments. However, the ultimate responsibility for Section 7 compliance remains with the Federal agency, and written notice should be provided to the Service upon such a designation. We recommend that Federal agencies provide their non-Federal representatives with proper guidance and oversight during preparation of biological assessments and evaluation of potential impacts to listed species.

Section 7(d) of ESA requires that the Federal agency and permit or license applicant shall not make any irreversible or irretrievable commitment of resources which would preclude the formulation of reasonable and prudent alternatives until consultation on listed species is completed.

*Pursuant to Section 7(a)(4) of the Act, if it is determined that any <u>proposed</u> species may be jeopardized, the Federal agency should contact us to discuss conservation measures for those species.

If you have any questions, contact me or Stephen Torbit of my staff at the letterhead address or FTS 328-2374/(307) 772-2374. I have included a copy of black-footed ferret search guidelines for your convenience.

Sincerely,

R.G. Starkey

Ronald G. Starkey
State Supervisor
Wyoming State Office

United States Department of the Interior
FISH AND WILDLIFE SERVICE
Fish and Wildlife Enhancement
2617 East Lincolnway, Suite A
Cheyenne, Wyoming 82001

IN REPLY REFER TO
W.37 USAF GWEN Sites

February 5, 1991

Elizabeth Bergen
Earth Metrics
2855 Campus Drive
Suite 300
San Mateo, California 94403

Dear Ms. Bergen:

This responds to your letter of January 7, 1991 and associated assessments regarding the development of a GWEN site in Hot Springs County, Wyoming. This office received your letter on January 10, 1991.

Based upon the biological information and project stipulations provided in the assessments, we concur with your conclusion that the development of a GWEN Site in Hot Springs County, Wyoming is not likely to adversely affect the endangered bald eagle (Haliaeetus leucocephalus), peregrine falcon (Falco peregrinus), or black-footed ferret (Mustela nigripes). We appreciate your efforts to ensure the conservation of these endangered species as a part of our joint responsibilities under the Endangered Species Act, as amended.

We recommend all impacts to wetlands be avoided, if avoidance is not possible, all wetland impacts should be fully mitigated. Additionally, we are concerned about the possibility of contamination of wetlands and aquifers from copper leachate at GWEN Sites 15 and 20. We recommend that you do not select either of these two sites because of contaminate problems or any other sites where wetlands or aquifers could be contaminated from GWEN construction.

If you have any questions, contact me or Stephen Torbit of my staff at the letterhead address or (307) 772-2374 (FTS 328-2374).

Sincerely,

R. G. Starkey

Ronald G. Starkey
State Supervisor
Wyoming State Office

cc:
Assistant Regional Director, FWE, Denver, CO (FWE-60120)
Field Supervisor, MT/WY, FWE, Helena, MT (FWE-61125)
Director, WGFD, Cheyenne, WY
Nongame Coordinator, WGFD, Lander, WY
SCT/RGS/mcm (USAFGWEN.CNR)

MIKE SULLIVAN
GOVERNOR

1890-1990 WYOMING CENTENNIAL A LASTING LEGACY

Wyoming State Archive
Museums & Historical Department

DAVID KATHKA, Ph.D.
DIRECTOR

BARRETT STATE OFFICE BUILDING • CHEYENNE, WY 82002 • (307) 777-7519

May 21, 1990

Earth Metrics Inc.
2855 Campus Drive, Suite 300
San Mateo, CA 94403

RE: GWEN RNE #10049A, SHPO #0590RLB059

Dear Sir:

Richard Bryant of our staff has received information concerning the aforementioned project. Thank you for giving us the opportunity to comment.

Prior to any ground disturbing activity, an on-site cultural resource survey meeting the Secretary of Interior's Standards for Archaeology and Historic Preservation (48FR44716) should be conducted and adverse impacts to any significant cultural resource sites must be mitigated. The survey and any necessary mitigation measures must be conducted by a professionally qualified archeologist or historian. A report detailing the results of these efforts must be reviewed by SHPO staff prior to our commenting on the project's effects on cultural resource sites.

Please refer to SHPO project control number #0590RLB059on any future correspondence dealing with this project. If you have any questions, contact Mr. Bryant at 777-6292.

Sincerely,

Thomas E. Marceau
Deputy SHPO

FOR:
Dave Kathka, Ph.D.
State Historic Preservation Officer

TEM:RLB:klm
Enclosure

Department of Commerce
WYOMING

December 27, 1990

Ms. Holly Mendel
SRI International
333 Ravenswood Avenue
Menlo Park, CA 94025

RE: U.S. Air Force GWEN Node Sites, SHPO #0390RLB059

Dear Ms. Mendel:

Rick Bryant and Ted Dunn of our staff have received information concerning the aforementioned project. Thank you for giving us the opportunity to comment.

We have reviewed the project report and find that the documentation meets the Secretary of the Interior's Standards for Archaeology and Historic Preservation (48FR44716-42). The National Register eligibility of sites 48H073, 48H0398, 48H0520, 48H0521, 48H0522, 48H0523 and 48H0524 is unknown but these siteswill not be affected by the project as presently planned. Site 48H0474 does not meet the criteria of eligibility for the National Register of Historic Places and no further work or protective measures are necessary. Site 48H0207 (Bridger Trail) meets the criteria of eligibility for the National Register of Historic Places but this non-contributing segment will not be affected by the project as presently planned.

We recommend that the Bureau of Land Management (BLM) allow the project to proceed in accordance with state and federal laws subject to the following stipulation: If any cultural materials are discovered during construction, work in the area should halt immediately and BLM staff and SHPO staff must be contacted. Work in the area may not resume until the materials have been evaluated and adequate measures for their protection have been taken.

This letter should be retained in your files as documentation of our determination of "no effect" for this project.

Please refer to SHPO project control number #0390RLB059 on any future correspondence dealing with this project. If you have any questions, contact Mr. Bryant at 777-6292 or Mr. Dunn at 777-6694.

Sincerely,

Thomas E. Marceau
Deputy SHPO

FOR:
Dave Kathka, Ph.D.
State Historic Preservation Officer

TEM:RLB:tsu rk1#

STATE HISTORIC PRESERVATION OFFICE

Mike Sullivan
Governor

R.D. "Max" Maxfield
Director, Department of Commerce

1825 Carey Avenue
Cheyenne, Wyoming 82002-0240
(307) 777-7697
FAX (307) 632-2748

Department of Commerce
W Y O M I N G

August 31, 1990

Earth Metrics Inc.
2855 Campus Drive, Suite 300
San Mateo, CA 94403

RE: GWEN (SHPO #0390RLB059)

Dear Ms. Bergen:

I have reviewed the latest documentation on the GWEN site selection process. We believe a class III (intensive) cultural resource survey of the proposed parcels should be conducted unless the parcel meets one of the standard WSHPO exclusion criteria:

1) The project's area of effect has been inventoried previously by a documented class III survey of sufficient quality to meet current SHPO and Secretary of the Interior's Standards.

2) Previous class III or class II surveys indicate that the potential for any historic and prehistoric sites to exist in the area of effect is extremely low or non-existent.

3) The project's area of effect has been previously disturbed to such an extent that the probability of intact cultural resource materials or sites remaining in the area is remote.

I have enclosed some guidelines for conducting class III surveys in Wyoming. If you have any questions, please contact me at 777-6292.

Sincerely,

Richard L. Bryant
Review & Compliance Program Manager

RLB:klm
Enclosures

Mike Sullivan
Governor

R.D. "Max" Maxfield
Director

Barrett Building
2301 Central Avenue
Cheyenne, Wyoming 82002
(307) 777-7695
FAX No. (307) 777-6005

Administration Division
Parks & Cultural Resources Division
Tourism & State Marketing Division
Economic & Community Development Division

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, OMAHA DISTRICT
215 NORTH 17TH STREET
OMAHA, NEBRASKA 68102-4978

REPLY TO ATTENTION OF

November 16, 1990

Cheyenne Regulatory Office
504 West 17th Street, Suite 280
Cheyenne, Wyoming 82001

Ms. Elizabeth Bergen
Earth Metrics Incorporated
2855 Campus Drive, Suite 300
San Mateo, California 94403

Dear Ms. Bergen:

This letter is in response to your request to Ed Gooley of our Riverton Regulatory Office to make wetland delineations on six properties in Hot Springs County, Wyoming. The delineations are for the proposed ground wave emergency radio network planned by the United States Air Force. The six sites are located as follows:

1. CGS-09 NW NE, Section 34, T44N, R94W
2. CGS-10 SE NE, Section 31, T44N, R94W
3. CGS-14 NE NE, Section 15, T43N, R95W
4. CGS-15 SE SE, Section 10, T43N, R95W
5. CGS-20 SW SW, Section 7, T43N, R96W
6. CGS-21 SE SW, Section 12, T43N, R97W

The results of the delineation are that only sites 4 and 5 have wetland areas.

On site #4, the wetlands start downhill from the ditch which crosses the property about 100 feet west of the north-south fence just west of the area you show on your drawing as a wet weather channel. The wetlands follow the channel down probably to Highway 170. There were definitely wetland plants, soils and hydrologic indicators for wetlands between the ditch and the channel where the two are in close proximity. However, once the two diverge, the plants change. Due to the time of year those plants in the drainage away from the ditch could not be identified. However, the channel does have the soils and hydrologic indicators for wetlands, so wetland plants are probably also present. Wetlands follow the ditch on the downhill side for most of its length. The wetlands are interspersed with hummocks of upland.

If you follow the ditch eastward for about 1/8 mile past where the wet weather channel leaves the ditch, there is a metal gate in the ditch. Just east, southeast of this there is a rather large wetland complex (about 3 acres) dominated by Carex sp. According to the information you provided, the ditch does not irrigate the area where the radio tower, etc., are to go. Therefore, the wetlands created by seepage from the ditch are subject to regulation under Section 404 of the Clean Water Act.

On site #5, the wetlands follow what you call a wet weather channel. The wetlands extend from the road on the west side to the east property line. The channel appears to carry irrigation return flows so the wetlands in it are also subject to regulation. The rest of the site is upland.

On site #3, there may be some wetlands along the creek bottom on the east boundary. However, livestock have eaten the vegetation down to such an extent that a positive determination could not be made at this time. If you desire, it can be rechecked next growing season. Let Mr. Gooley know if you want this done.

If you have any questions on this matter, please contact Mr. Gooley at (307) 856-5283.

Sincerely,

Matthew A. Bilodeau
Regulatory Branch
Operations Division

Copies Furnished:

Omaha Dist., Corps of Engineers
Riverton Regulatory Office

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, OMAHA DISTRICT
215 NORTH 17TH STREET
OMAHA, NEBRASKA 68102-4978

REPLY TO ATTENTION OF

February 4, 1991

Cheyenne Regulatory Office
504 West 17th Street, Suite 280
Cheyenne, Wyoming 82001

Ms. Mary Dipiero
S.R.I., Inc.
333 Rosenwood Avenue, Room AG344
Melene Park, California 94025-3493

Dear Ms. Dipiero:

This letter is in reference to your January 31, 1991, telephone conversation with Ed Cooley of our Riverton Regulatory Office. You discussed wetlands on two of the proposed Air Force ground wave radio antenna sites in Hot Springs County, Wyoming.

If either of the two proposed sites which have wetlands on them is chosen for the antenna site, a Department of the Army permit pursuant to Section 404 of the Clean Water Act will be required for any fills placed into the wetlands. Corps of Engineers Nationwide Permit #26 (See Fact Sheet attached) authorizes the filling of up to one acre of waters or wetlands subject to regulation. Proposed fills for antenna construction may be authorized by this permit.

This determination does not eliminate the requirement that you obtain any other applicable Federal, state, or local permits as may be required. You may want to contact the U.S. Fish and Wildlife Service (307-772-2374) to discuss your project.

Mr. Cooley's wetland determinations on your proposed antenna sites were accomplished on October 23 and November 13, 1990.

Please call Mr. Cooley at 307-856-5283 if you have any questions on this nationwide permit or this matter.

Sincerely,

Matthew A. Bilodeau

Matthew A. Bilodeau
Regulatory Branch
Operations Division

Enclosure

33 CFR Section 330.5 Nationwide Permits

(a) Authorized Activities.

(26) Discharges of dredged or fill material into non-tidal rivers, streams, and their lakes and impoundments, including adjacent wetlands, that are located above the headwaters; and other non-tidal waters of the United States, including adjacent wetlands, that are not part of a surface tributary system to interstate waters or navigable waters of the United States (i.e., isolated waters), except those discharges which cause the loss or substantial adverse modification of 10 acres or more of such waters of the United States. For discharges which cause the loss or substantial adverse modification of 1 to 10 acres of such waters, including wetlands, notification to the district engineer is required in accordance with 33 CFR Section 330.7.

(b) Conditions: The following special conditions, where applicable, must be complied with for the Nationwide Permit authorization to remain valid:

(1) That any discharge of dredged or fill material will not occur in the proximity of a public water supply intake.

(2) That any discharge of dredged or fill material will not occur in areas of concentrated shellfish production unless the discharge is directly related to a shellfish harvesting activity authorized by 33 CFR Part 330.5(a)(4).

(3) That the activity will not jeopardize a threatened or endangered species as identified under the Endangered Species Act (ESA), or destroy or adversely modify the critical habitat of such species.

(4) That the activity shall not significantly disrupt the movement of those species of aquatic life indigenous to the waterbody (unless the primary purpose of the fill is to impound water).

(5) That any discharge of dredged or fill material shall consist of suitable material free from toxic pollutants (see Section 307 of the Clean Water Act) in toxic amounts.

(6) That any structure for fill authorized shall be properly maintained.

(7) That the activity will not occur in a component of the National Wild and Scenic River System; nor in a river officially designated by Congress as a "study river" for possible inclusion in the system, while the river is in an official study status.

(8) That the activity shall not cause an unacceptable interference with navigation.

(9) That, if the activity may adversely affect historic properties which the National Park Service has listed on, or determined eligible for listing on, the National Register of Historic Places, the permittee will notify the district engineer. Furthermore, that, if the permittee before or during prosecution of the work authorized, encounters a historic property that has not been listed or determined eligible for listing on the National Register, but which may be eligible for listing in the National Register, he shall immediately notify the district engineer.

(10) That the construction or operation of the activity will not impair reserved tribal rights, including, but not limited to, reserved water rights and treaty fishing and hunting rights.

33 CFR Section 330.6 Management Practices

(a) In addition to the conditions specified above, the following management practices shall be followed, to the maximum extent practicable, in order to minimize the adverse effect of these discharges on the aquatic environment. Failure to comply with these practices may be cause for the district engineer to recommend, or the division engineer to take, discretionary authority to regulate the activity on an individual or regional basis pursuant to 33 CFR 330.8.

(1) Discharges of dredged or fill material into waters of the United States shall be avoided or minimized through the use of other practical alternatives.

(2) Discharges in spawning areas during spawning seasons shall be avoided.

(3) Discharges shall not restrict or impede the movement of aquatic species indigenous to the waters or the passage of normal or expected high flows or cause the relocation of the water (unless the primary purpose of the fill is to impound waters).

(4) If the discharge creates an impoundment of water, adverse impacts on the aquatic system caused by the accelerated passage of water and/or the restriction of its flow shall be minimized.

(5) Discharges in wetland areas shall be avoided.

(6) Heavy equipment working in wetlands shall be placed on mats.

(7) Discharges into breeding areas for migratory waterfowl shall be avoided.

(8) All temporary fills shall be removed in their entirety.

United States Department
of the Interior
Fish and Wildlife Service
Fish and Wildlife Enhancement
Attn: Mr Ronald G. Starkey
2617 East Lincolnway, Suite A
Cheyenne, WY 82001

RE: U.S. Air Force Ground Wave Emergency Network (GWEN) Project in Central Wyoming

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This is to verify that no changes have been made to the list of federally-designated threatened, endangered, or candidate species sent on August 14, 1990.

Charles P. Davis
~~Ronald G. Starkey~~
Charles P. Davis

4-29-92
Date

Changes have been made to the list of federally-designated threatened, endangered, or candidate species since our correspondence to you on August 14, 1990. Enclosed is a new list of species.

Ronald G. Starkey

Date

United States Department of the Interior
FISH AND WILDLIFE SERVICE
Fish and Wildlife Enhancement
2617 East Lincolnway
Cheyenne, WY 82001

TAKE PRIDE IN AMERICA

IN REPLY REFER TO:

FWE-61411
spb/W.10(dodgwen.spl)

January 6, 1993

Lt. Col. Stephen T. Martin
Department of the Air Force
Headquarters Electronic Systems Division (AFSC)
Hanscom Air Force Base, Massachusetts 01731-5000

Dear Colonel Martin:

This responds to your letter of December 17, 1992, received by this office on December 23, 1992, requesting verification of the lists of endangered, threatened and candidate species potentially affected by the Ground Wave Emergency Network project in central Wyoming near Thermopolis.

No listed species have been added since our original letter of August 14, 1990, however, new bald eagle (Haliaeetus leucocephalus) nests have been established along the Big Horn River near Thermopolis in recent years. Many new candidate species were named in the November 21, 1991, Animal Candidate Review for Listing as Endangered or Threatened Species. Several of these may be found in the vicinity of the project. A complete list of endangered and candidate species potentially affected by the project follows.

LISTED SPECIES	STATUS	EXPECTED OCCURRENCE
Black-footed ferret (Mustela nigripes)	Endangered	Potential resident in prairie dog (Cynomys sp.) colonies.
Bald eagle (Haliaeetus leucocephalus)	Endangered	Nesting. Winter resident. Migrant.
Peregrine falcon (Falco peregrinus)	Endangered	Migrant.

Candidate species that may occur within the project area are identified below. Many Federal agencies have policies to protect candidate species from further population declines. Our office would appreciate receiving any information available on the status of these species in or near the project area.

SPECIES	CATEGORY*	SCIENTIFIC NAME	EXPECTED OCCURRENCE
Mammals			
Spotted bat	2	Euderma maculatum	Bighorn County
Allen's 13-lined ground squirrel	2	Spermophilus tridecemlineatus alleni	W.slope BH mts. & upper Green R.
Birds			
White-faced ibis	2	Plegadis chihi	wetlands statewide
Ferruginous hawk	2	Buteo regalis	grasslands statewide
Mountain plover	1	Charadrius montanus	grasslands statewide
Long-billed curlew	3C	Numenius americanus	grasslands/wetlands
Black tern	2	Chlidonias niger	wetlands statewide
Loggerhead shrike	2	Lanius ludovicianus	woodlands/shrublands
Fish			
Sturgeon chub	2	Hybopsis gelida	Powder & BH R. River drges.
Invertebrates			
Cave Physa (= Wyoming cave snail)	2	Physella (Physa) spelunca	Kane Cave, BH County

*1 = Federal T/E listing appears appropriate and is anticipated. 2 = Current data insufficient to support listing. 3C = More widespread or abundant than previously believed, or no immediate threats identified.

Section 7(c) of ESA requires that Federal agencies proposing major construction actions complete a biological assessment to determine the effects of the proposed actions on listed and proposed species. If a biological assessment is not required (i.e., all other actions), the lead Federal agency is responsible for review of proposed activities to determine whether listed species will be affected. We would appreciate the opportunity to review your determination document.

For those actions where a biological assessment is necessary, it should be completed within 180 days of initiation, but can be extended by mutual agreement between your agency and the Fish and Wildlife Service (Service). If the assessment is not initiated within 90 days, the list of T/E species should be verified with the Service prior to initiation of the assessment. The biological assessment may be undertaken as part of your agency's compliance of Section 102 of the National Environmental Policy Act (NEPA), and incorporated into the NEPA documents. We recommend that biological assessments include:

1. a description of the project;
2. a description of the specific area potentially affected by the action;
3. the current status, habitat use, and behavior of T/E species in the project area;
4. discussion of the methods used to determine the information in item 3;
5. direct and indirect impacts of the project to T/E species;
6. an analysis of the effects of the action on listed and proposed species and their habitats including cumulative impacts from Federal, State, or private projects in the

area;

7. coordination measures that will reduce/eliminate adverse impacts to T/E species;
8. the expected status of T/E species in the future (short and long term) during and after project completion;
9. determination of "is likely to adversely affect" or "is not likely to adversely affect" for listed species;
10. determination of "is likely to jeopardize" or "is not likely to jeopardize" for proposed species;
11. citation of literature and personal contacts used in assessment.

If it is determined that any agency program or project "is likely to adversely affect" any listed species, formal consultation should be initiated with us. If it is concluded that the project "is not likely to adversely affect" listed species, we should be asked to review the assessment and concur with the determination of no adverse effect.

A Federal agency may designate a non-Federal representative to conduct informal consultation or prepare biological assessments. However, the ultimate responsibility for Section 7 compliance remains with the Federal agency, and written notice should be provided to the Service upon such a designation. We recommend that Federal agencies provide their non-Federal representatives with proper guidance and oversight during preparation of biological assessments and evaluation of potential impacts to listed species. Section 7(d) of ESA requires that the Federal agency and permit or license applicant shall not make any irreversible or irretrievable commitment of resources which would preclude the formulation of reasonable and prudent alternatives until consultation on listed species is completed.

If you have any questions please contact Steve Brockmann of my staff at the letterhead address or phone (307) 772-2374.

Sincerely,

for Charles P. Davis
State Supervisor
Wyoming State Office

cc: Director, WGFD, Cheyenne, WY
Nongame Coordinator, WGFD, Lander, WY

APPENDIX D

GLOSSARY

GLOSSARY

Abbreviations and Units of Measure

AM	Amplitude modulation
ATU	Antenna tuning unit
BLM	Bureau of Land Management
BRC	Biota Research and Consulting
Btu	British thermal unit
BUPG	Back-up power group
CGS	Candidate GWEN site
COE	U.S. Army Corps of Engineers
dBA	Decibels on the A-weighted scale, which is a measure of the intensity of the sounds people can hear
EA	Environmental Assessment
FAA	Federal Aviation Administration
FEIS	Final Environmental Impact Statement; in this document, the term refers to the FEIS for the GWEN Final Operational Capability that was released in September 1987 by the U.S. Air Force, Electronic Systems Division, Hanscom Air Force Base, Massachusetts

FIA	Federal Insurance Administration
FICWD	Federal Interagency Committee for Wetland Delineation
FOC	Final Operational Capability, the third phase of development of GWEN
GPO	Government Printing Office
GWEN	Ground Wave Emergency Network
HEMP	High-altitude electromagnetic pulse
IICEP	Interagency and Intergovernmental Coordination for Environmental Planning, the formal review process for the EA
kHz	Kilohertz
LF	Low frequency
mg/l	Milligrams per liter
MM	Modified Mercalli, a scale of the severity of earthquake effects
µg/l	Micrograms per liter
NRC	National Research Council, the principle operating agency of the National Academy of Sciences and the National Academy of Engineering
NRHP	National Register of Historic Places

PAWS	Potential areawide sites; the portion(s) of an SSA left after application of those siting criteria that do not require a field survey, such as the location of national and state parks
PCGS	Potential candidate GWEN site; any site that is identified from roadside surveys as suitable for further investigation
PGS	Preferred GWEN site; the CGS identified by the Government that represents the Government's preferred location for a relay tower
PSER	Preliminary Site Evaluation Report
ROE	Right-of-entry
SCS	Soil Conservation Service, a unit of the United States Department of Agriculture
SHPO	State Historic Preservation Officer; the person responsible for administering the National Historic Preservation Act at the state level, reviewing National Register of Historic Places nominations, maintaining data on historic properties that have been identified but not yet nominated, and consulting with federal agencies concerning the impacts of proposed projects on known and unknown cultural resources
SSA	Site search area; the 250-square-mile area within which four to six CGSs are identified; the SSA is the area within a 9-mile radius of a set of nominal coordinates in the network design. It is used as a manageable range in which to conduct siting investigations
TLCC	Thin Line Connectivity Capability; the second phase of development of GWEN

UHF	Ultrahigh frequency (band); specifically 300 to 3,000 megahertz
USAF	United States Air Force
USC	United States Code
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
VMC	Visual Modification Class
WHD	Wyoming Highway Department

Definitions

Air pollutant	An atmospheric contaminant, particularly the 15 atmospheric contaminants specified in federal and most state regulations
Alluvium	Pertaining to loose river sediments, such as clay, silt, sand, and gravel
Anaerobic	Occurring in the absence of free oxygen
Anticline	An arch of stratified rock in which the layers bend downward in opposite directions from the crest
Badlands	A region marked by intricate erosional sculpturing, scanty vegetation, and fantastically formed hills

Batholith	A great mass of intruded igneous rock that for the most part stopped in its rise a considerable distance below the surface
Berm	A mound or wall of earth
Candela	A unit of measure of the intensity of light equal to the brightness of one candle
Class III Cultural Resources Survey	A survey designed to identify properties that are listed, eligible for listing, or potentially eligible for listing on the National Register of Historic Places within the area that would be affected by the proposed project, and to evaluate the impact of the proposed project on such properties
Colluvium	Rock detritus and soil accumulated at the foot of a slope
Cretaceous period	Geologic period of time 66 million to 144 million years ago
Cultural resource	Prehistoric, Native American, and historic sites, districts, buildings, structures, objects, and any other physical evidence of past human activity
Evaluative criteria	Applied to portions of a potential siting area for a GWEN facility to determine its suitability. Areas that rank low against evaluative criteria may be excluded from consideration, or given a low priority in the site selection process
Exclusionary criteria	Criteria used to eliminate or exclude highly sensitive areas or areas that do not meet the limits of acceptable performance from consideration for GWEN facilities

Fault	A break in the continuity of a rock formation caused by a shifting or dislodging of the earth's crust; adjacent surfaces are differentially displaced parallel to the plane of fracture
Federal jurisdictional wetland	As defined in the *Federal Manual for Identifying and Delineating Jurisdictional Wetlands* (GPO 1989-236-985/00336), a wetland is a class of habitats distinguished by the presence of saturation to the surface or standing water during at least 1 week of the growing season (wetland hydrology), a soil type characteristic of saturated or poorly drained conditions (hydric soils), and the predominance of plants that only or mostly occur on wet sites (hydrophytic vegetation)
Floodplain	Land adjacent to a river that is commonly covered by water during high flow periods
Fold	A bend or flexure produced in rock by forces operative after the depositing or consolidation of the rock
Ground plane	A part of the antenna system consisting of buried copper wires that extend radially from the base of a GWEN tower for a distance of approximately 330 feet
Historic properties	Those cultural resources that are listed or eligible for listing on the National Register of Historic Places
Holocene epoch	Geologic period of time from 0 to 1 million years ago
Hydric soil	A soil that is saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions in the upper part

Magma	Molten rock material within the earth from which an igneous rock results by cooling
Mesozoic era	A geologic period of time 66 million to 245 million years ago
Modified Mercalli scale	A measure of the intensity of seismic activity based on human perception of the event and the potential for damage; the intensity is rated on a Roman numeral scale ranging from I to XII. An earthquake of MM intensity I would be detectable only by seismographs; MM intensity V would shake buildings, break dishes and glassware, and cause unstable objects to fall; MM intensity X would destroy most masonry and frame structures, bend railroad rails slightly, and cause large tidal waves and landslides; MM intensity XII would cause nearly total destruction of all buildings. Another commonly used seismic intensity scale, based on readings from a seismograph, is the Richter scale, which was developed in 1935. The Modified Mercalli scale is often used when the historic period to be covered includes data prior to 1935
Paleonto-logical	Pertaining to fossils or the study of fossils
pH	Measure of acidity in which the lower the number, the more acid the substance; 7 represents neutrality
Pleistocene epoch	Geologic period of time from 1 million to 2 million years ago
Prime farmland	Land that contains soils having high crop production either naturally or through modification; the U.S. Soil Conservation Service is responsible for designating prime farmland

Quaternary period	Geologic period of time 0 to 2 million years ago
Riparian	Pertaining to the bank of a natural course of water
Sedimentary rock	Rock formed by the consolidation or cementation of particles deposited by water or wind
Sodic	Relating to or containing sodium
Tertiary period	Geologic period of time 2 million to 66 million years ago
Top-loading element	Portions of the GWEN antenna that extend diagonally from the top of the tower, which strengthen the signal and provide additional structural support like guy wires